AVIATION WEEK

A McGRAW-HILL PUBLICATION

JANUARY 30, 1956

50 Cents

SAGE System Puts Automation Into Air Defense

'Honest John' Missile in Europe Defense Force

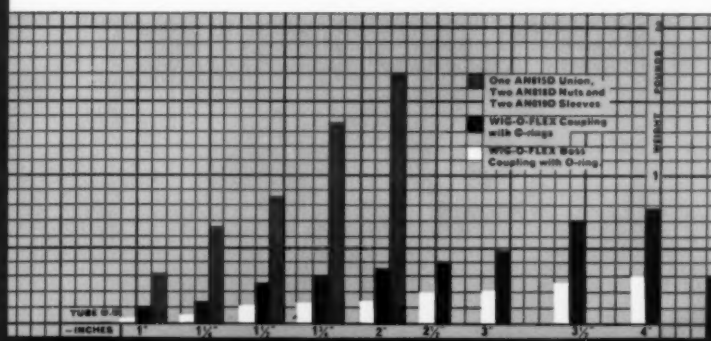
Are You Interested In WEIGHT REDUCTION?

WIGGINS COUPLINGS SAVE 88 POUNDS ON LOCKHEED C-130

America's first turbo-prop transport—the Lockheed C-130—is 88 pounds lighter because WIG-O-FLEX Couplings replaced standard AN connections and cut hose. WIG-O-FLEX Couplings weigh 1/5 as much as the standard AN connections they can replace. (See Weight Chart for exact comparisons.)

WIG-O-FLEX® COUPLING

flexible union for connecting rigid tubes


One AN815D Union, Two AN818D Nuts and Two AN819D Sleeves
WIG-O-FLEX Coupling with O-rings
WIG-O-FLEX Boss Coupling with O-ring
WEIGHT - POUNDS
TUBE O.D. - INCHES

WEIGHT COMPARISON CHART
WIG-O-FLEX COUPLING & AN STANDARD FLARED TUBE CONNECTION

PROVED SUPERIOR FOR FUEL, OIL, AIR

- Withstands more than 1000 psi burst pressure.
- Accommodates 4° tube flexure.
- Installs locally, 80% lighter.
- Temperature range —65°F to +250°F.

SIZES: 1", 1¼", 1½", 1¾", 2", 2½", 3", 3½", 4"

WRITE FOR FURTHER INFORMATION

Wiggins

E. B. WIGGINS OIL TOOL COMPANY, INC.
3424 East Olympic Boulevard, Los Angeles 23, California

AXELSON IN ACTION

FROM 115 MPH...TO MACH 1.0 +

YESTERDAY...TODAY...TOMORROW...
EXPERIENCE BUILDS AMERICA'S AIRCRAFT.

In 1929, Axelson was building engines for Boeing's Model 203 Trainers and other leading airplanes.

Today, Axelson produces landing gears, shock struts, spars, geared mechanisms, hydraulic components and other precision equipment . . . for such aircraft as the A3D, A4D, B47, B52, B57, B66, F89, F94.

Axelson experience is also being applied to missiles, the transition between today's and tomorrow's aircraft. Some of the most advanced types incorporate Axelson-produced components.

For 30 years, the aircraft industry has looked to Axelson for *proven* production know-how. Now, a new look* at Axelson shows even greater depth in research, design and development . . . broader on-schedule service . . . available for complete programs or individual precision components.

*Brochure AW-1 will give you a completely new look at Axelson. Write for it today.

Design and development engineers, desiring to work on advanced aircraft projects, contact Director of Engineering.

DIVISION OF U. S. INDUSTRIES, INC.

AXELSON

MANUFACTURING COMPANY

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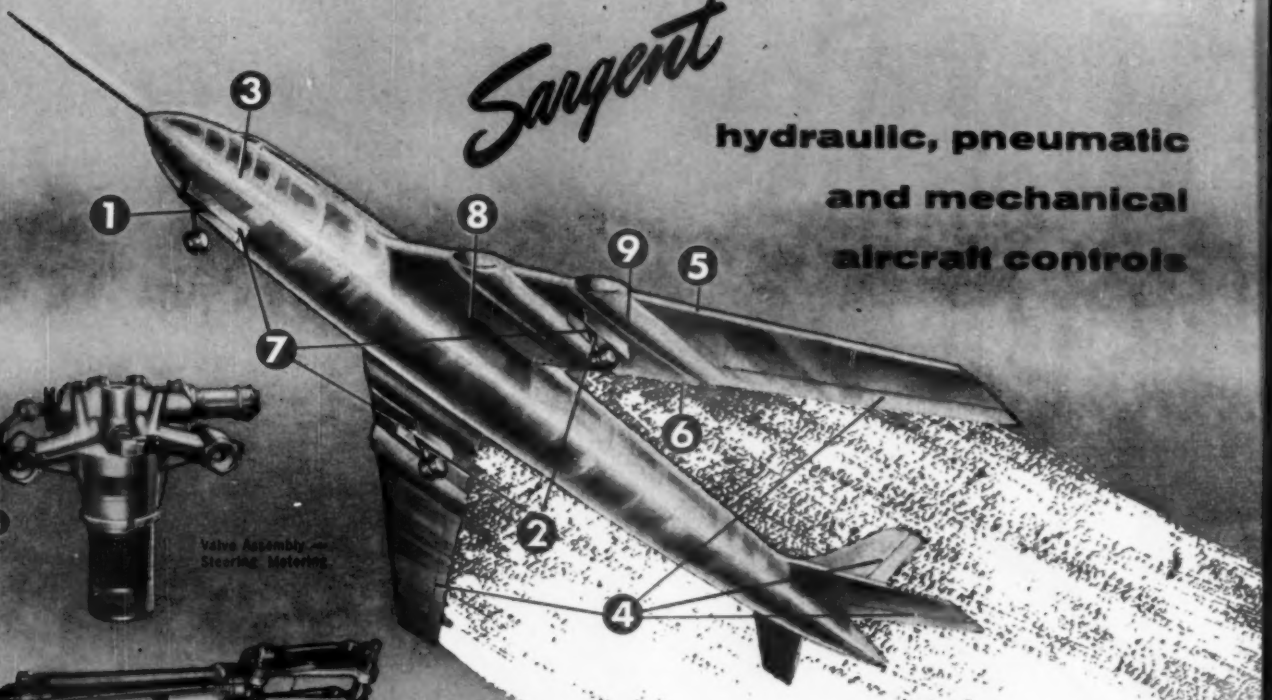
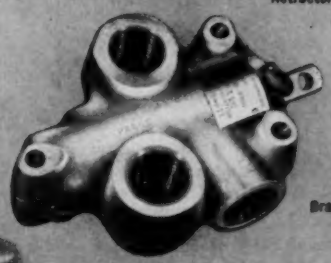
Sargent

hydraulic, pneumatic and mechanical aircraft controls

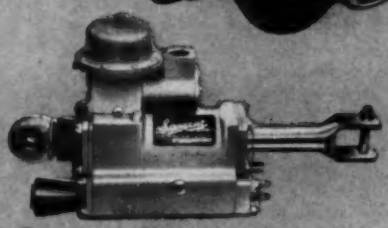


1 Valve Assembly — Steering, Metering

2 Main Landing Gear Retractor



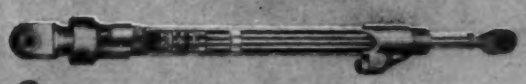
3 Brake Valves



4 Power control units for rudder, elevators and flaperons

5 Slat Actuating Cylinder

6 Gear Box Assembly — Outer Wing Flap Drive



7 Pneumatic Door Lock

provide precision performance

For more than 35 years Sargent Engineering Corporation has designed and manufactured precision equipment.

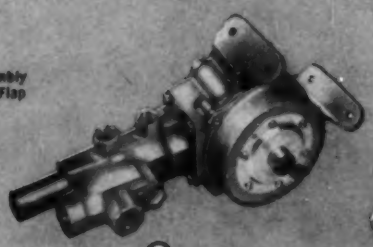
During the past 18 years Sargent has delivered more than 150,000 precision aircraft control units to the country's leading airframe manufacturers. Today Sargent manufactures 78 different hydraulic, pneumatic and mechanical units which are produced in a fully equipped modern plant, staffed by engineers and craftsmen skilled in the design and manufacture of these specialized aircraft components.

Sargent Engineering has developed the "know-how" to aid in the solution of difficult problems. Send your specifications for our proposal.

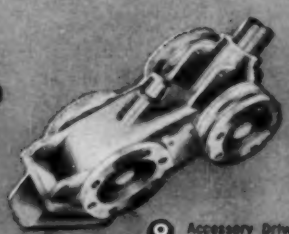
Write today for your copy of the illustrated story of Sargent's organization, methods and manufacturing facilities.

SARGENT BUILDS

Aircraft Power Control Assemblies • A Complete Line of Gears and Gear Assemblies • Actuating Cylinders • Shimmy Dampeners • Servo Valves • Sequence Valves • 3-Way and 4-Way Selector Valves • Directional Valves • Relief Valves • Pressure Regulators • Brake Valves • Pressure Reducing Valves



8 Spoiler Valve



9 Accessory Drive Power Take-off

Standard of Excellence — *Since 1920*

Sargent ENGINEERING CORPORATION
2533 EAST 56TH STREET
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"Good will" is the disposition of the pleased customer to return to the place where he has been well treated.
—U.S. Supreme Court

AVIATION CALENDAR

Feb. 2-3—National Symposium on Microwave Techniques, sponsored by Institute of Radio Engineers' Antenna & Propagation Group and Theory & Techniques Group, Philadelphia.

Feb. 3-4—Jet Age Conference, sponsored by the Air Force Association, Sheraton-Park Hotel, Washington, D. C.

Feb. 7-9—Society of the Plastics Industry, 11th annual Reinforced Plastics Div., conference, Chalfonte-Haddon Hall, Atlantic City, N. J.

Feb. 9-11—Institute of Radio Engineers Southwestern Regional Conference and Electronics Show, Skirvin Hotel and Civic Auditorium, Oklahoma City, Okla.

Feb. 16-17—Transistor Circuits Conference, University of Pennsylvania, Philadelphia. Sponsored by Institute of Radio Engineers, American Institute of Electrical Engineers and Univ. of Pa.

Feb. 22-24—Fifth Annual Ohio-Indiana Agricultural Aviation Conference, Ohio Union, Ohio State University Campus.

Mar. 6-8—Fourth Annual Air Line Pilot Association, Air Safety Forum, Shoreland Hotel, Chicago.

Mar. 14-16—1956 Aviation Div. Conference of the American Society of Mechanical Engineers, Beverly-Hilton Hotel, Los Angeles, Calif.

Mar. 19-21—Society of Automotive Engineers, national production meeting and forum, Hotel Statler, Cleveland, Ohio.

Mar. 19-22—Institute of Radio Engineers, national convention, Waldorf-Astoria Hotel & Kingsbridge Armory, New York.

Apr. 9-12—Society of Automotive Engineers, national acronautic meeting, acronautic production forum and aircraft engineering display, Hotel Statler, New York, N. Y.

Apr. 10-11—Symposium for Management on Application of Analog Computers, sponsored by Midwest Research Institute, University of Kansas City, Kansas City, Mo.

Apr. 18-19—First Annual National Industrial Research Conference, sponsored by Armour Research Foundation of Illinois Institute of Technology, Hotel Sherman, Chicago.

Apr. 22-26—American Association of Airport Executives, 29th annual convention, Hotel Carter, Cleveland, Ohio.

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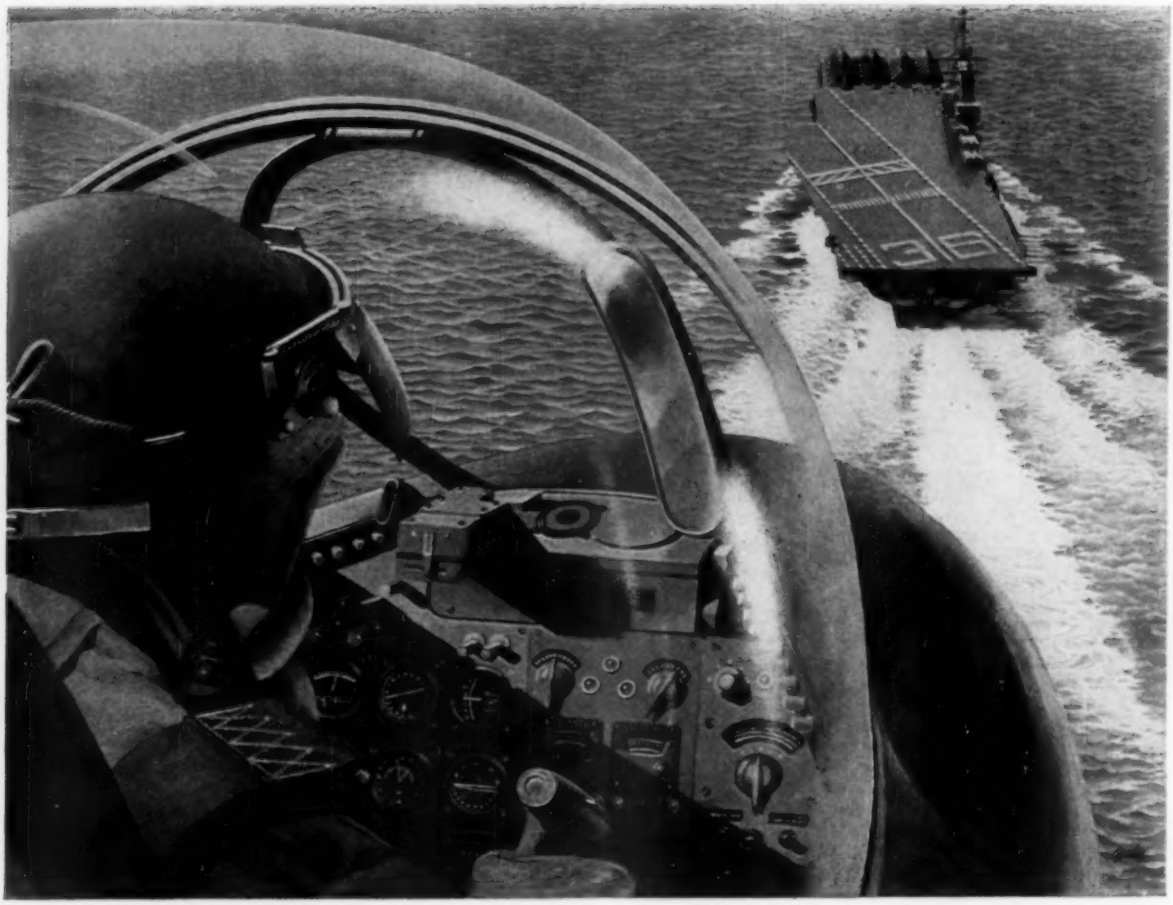
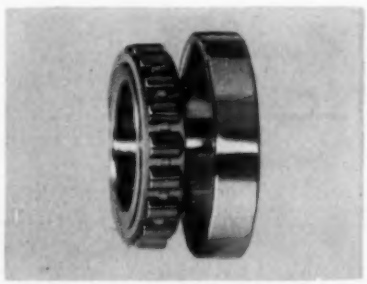


Margin for Error . . . *None!*

You swing into your final approach. At precisely the right instant the Landing Signal Officer flags you to cut your power—and you're aboard! ☆ Such skill and precision is indicative of that which is required today in *every* phase of the aircraft industry. The bearings in modern jet turbines, for instance, must be held to accurate tolerances measured in millionths of an inch. That's why the leading jet turbine manufacturers specify Bower aircraft bearings first. Their exceptional high quality and unerring precision allow Bower bearings to stand unbelievable turbine speeds and temperatures—that match the supersonic speeds of today's jet aircraft—*with a minimum of lubrication.* ☆ Whatever *you* produce, if it uses bearings, specify Bower! Choose from a complete line of tapered, straight and journal roller bearings for every field of transportation and industry.

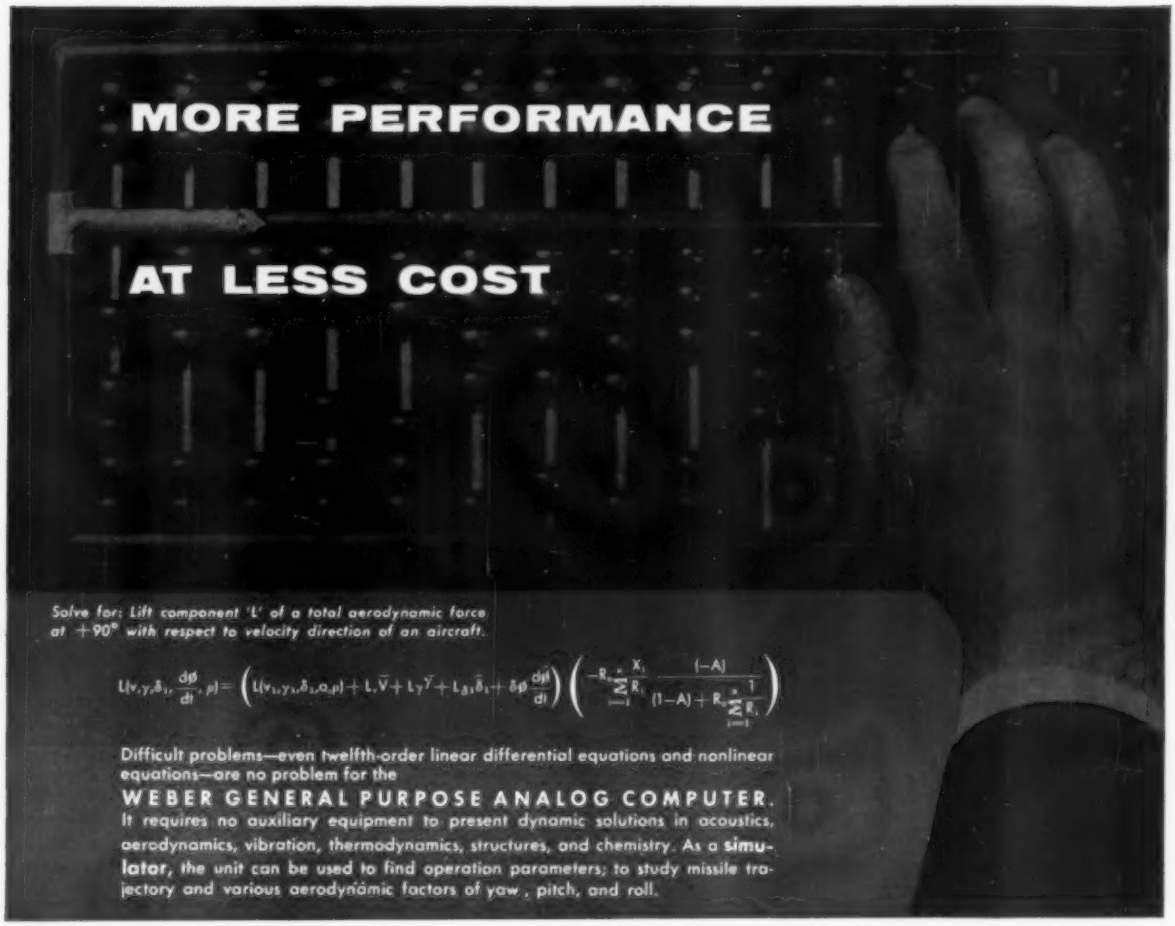
BOWER ROLLER BEARING DIVISION
FEDERAL-MOGUL-BOWER BEARINGS, INC. • DETROIT 14, MICHIGAN



IDEALLY SUITED TO HIGH-SPEED OPERATION

Built to hold their precision indefinitely, these aircraft bearings are recommended wherever superior quality and high-speed operation are required. For some applications, a special alloy steel—developed jointly by Bower and several aircraft companies—is used.

BOWER ROLLER BEARINGS



Solve for: Lift component 'L' of a total aerodynamic force at +90° with respect to velocity direction of an aircraft.

$$L(v,\gamma,\delta_1,\frac{d\phi}{dt},\rho)=\left(L(v_1,\gamma_1,\delta_1,\alpha,\rho)+L_v\bar{v}+L_\gamma\bar{\gamma}+L_{\delta_1}\bar{\delta}_1+\delta\phi\frac{d\phi}{dt}\right)\left(\frac{-R_n\sum_{i=1}^{n}\frac{X_i}{R_i}}{(1-A)+R_n\sum_{i=1}^{n}\frac{1}{R_i}}\right)$$

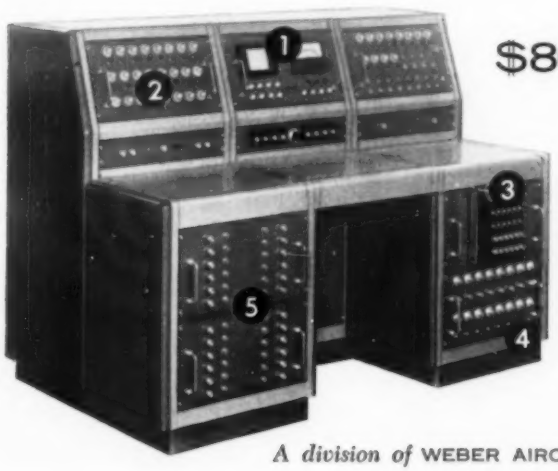
Difficult problems—even twelfth-order linear differential equations and nonlinear equations—are no problem for the

WEBER GENERAL PURPOSE ANALOG COMPUTER.

It requires no auxiliary equipment to present dynamic solutions in acoustics, aerodynamics, vibration, thermodynamics, structures, and chemistry. As a **simulator,** the unit can be used to find operation parameters; to study missile trajectory and various aerodynamic factors of yaw, pitch, and roll.

We think it's the greatest thing since the Model T, and if you don't believe you can get all of this for $8000, give us a chance to prove it to you. Write for more information.

Weber
ELECTRONICS



$8000 *Augmentive Functions Available*

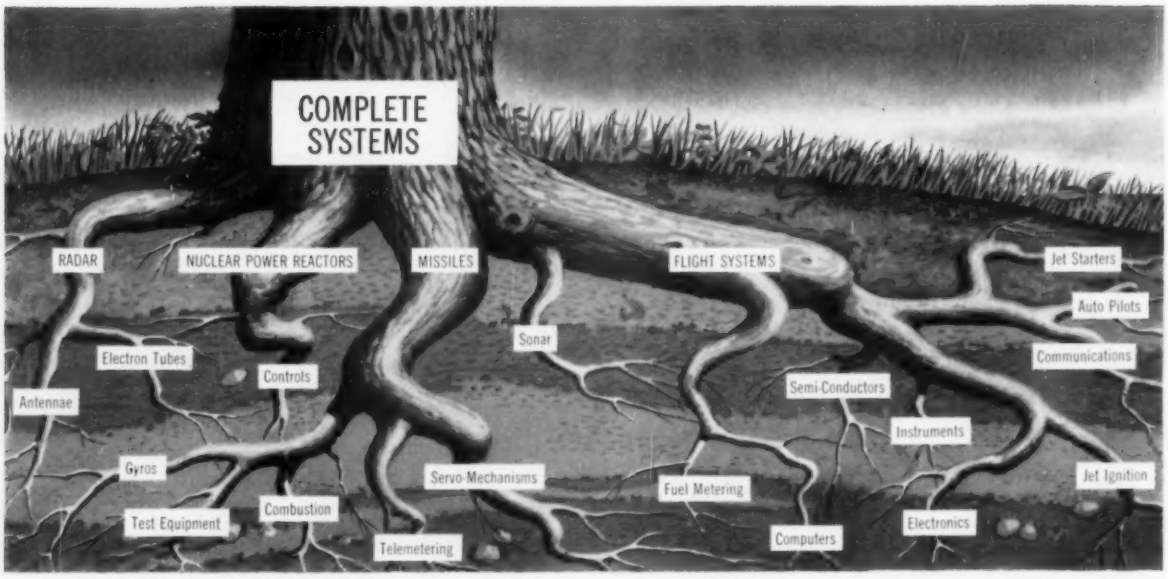
1. DUAL OPERATIVE TIME, real and fast, with instantaneous switching and 5" dual beam scope.
2. 36 POTENTIOMETERS
3. SIMPLIFIED EQUATION BOARD eliminates programming of problem.
4. FUNCTION GENERATOR included as standard equipment.
5. 24 AMPLIFIERS:
   12 integrating/summation; 12 summation.

CABINET DESIGN provides sliding racks for individual component housing.

A division of WEBER AIRCRAFT, *2820 Ontario Street, Burbank, California*

A THOUSAND PRODUCTS **Bendix** A MILLION IDEAS

AVIATION CORPORATION



Bendix reliable components + Bendix systems engineering + Bendix proven production ability assure DEPENDABLE SYSTEMS

The more deeply rooted you are in all the things of which systems are comprised, the better able you are to produce completely dependable systems.

Having produced millions of components, subsystems and complete systems for many years, Bendix Aviation is the logical direction to look for systems to solve many current problems as well as others anticipated. Bendix assets for systems work include:

MAN POWER—An engineering and research staff of over 9000 with a broader range of technical abilities than any in the country.

ENGINEERING AND RESEARCH—Over $80 million was expended on these functions in fiscal 1955.

PRODUCTION FACILITIES—Twenty-four widely dispersed manufacturing divisions located coast to coast employing nearly 50,000 people.

SYSTEMS PLANNING GROUP—Coordinates major systems work, giving you a single, centrally located contact—the Bendix Systems Planning Group, Bendix Aviation Corporation, Fisher Building, Detroit 2, Michigan.

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RESEARCH
PROTOTYPE DEVELOPMENT
MASS PRODUCTION

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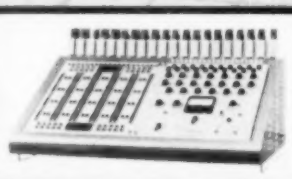
ELECTRONICS

Ideas That Become Finished Products

You can expect intelligent solution of your design problems, with fast processing to finished product, when you use the completely integrated development and production facilities of Hall-Scott Electronics. Advanced electronic engineering, manufacture, and assembly—including precision sheet metal work—are all carried on under one roof in an ultra-modern plant. Hall-Scott laboratories include advanced condition, simulation, electrical and mechanical testing equipment. The shops are tooled for efficient production of the most complex electronic equipment.

You can also expect the same high standards that have made the name Hall-Scott synonymous with dependability in research and development for industry and government over the past 40 years.

No matter what your electronic project may be, write for complete information on how Hall-Scott Electronics can assist you... 2950 North Ontario Street, Burbank, California, Dept. AW-130.



Desk-top **Analog Computer**, rapid and economical system synthesis.

Plug-in DC Amplifier, a system building-block.

Work now in process includes Ground Control Components for Missiles, Sensing Devices, Electronic Analyzers, Transistorized Power Packages, Plug in DC Amplifiers, Pre-flight Test Equipment, and Analog Computers.

HALL-SCOTT Since 1909

Hall-Scott Motors Company, *Electronics Division*

Burbank, California

7-3000

setting new standards for transparent enclosures

PLEXIGLAS 55

First used in 1952 for windows of the Douglas DC-6, PLEXIGLAS 55 was next specified for cockpit canopies of the Boeing B-47, shown above. Today this improved grade of aviation's standard transparent plastic is being used on more and more types of military and commercial planes.

Current production aircraft using PLEXIGLAS 55 include:

Boeing B-47	**Douglas A4D, F4D-2**
Beech T-34	**Douglas DC-7, DC-6B, DC-6**
Cessna T-37	**Lockheed T-33B**
Convair F-102	**Martin XP6M-1, B-57B**
North American FJ-4, F-100	

PLEXIGLAS 55 is characterized by notably improved craze-resistance and a higher maximum useful service temperature. Combined with the traditional clarity, formability and weathering properties of PLEXIGLAS acrylic plastic, these advantages provide significantly longer service life for transparent enclosures on current production aircraft. For the planes of the future, we are working to raise the quality of transparent plastic to an even higher level.

PLEXIGLAS is a trademark, Reg. U.S. Pat. Off., and in other principal countries of the Western Hemisphere.

CANADIAN DISTRIBUTOR: Crystal Glass & Plastics, Ltd., 130 Queen's Quay at Jarvis Street, Toronto, Ontario, Canada.

CHEMICALS FOR INDUSTRY

ROHM & HAAS COMPANY

WASHINGTON SQUARE, PHILADELPHIA 5, PA.

Representatives in principal foreign countries

Heart for a new Helicopter

...an achievement in precision and performance

The skill and craftsmanship of FOOTE BROS. in the manufacture of gears, actuators and assemblies has contributed to this achievement

Main rotor transmission for Sikorsky S-58 Helicopter

This trademark stands for the finest industrial gearing made!

FOOTE BROS. LIFETIME GEARING

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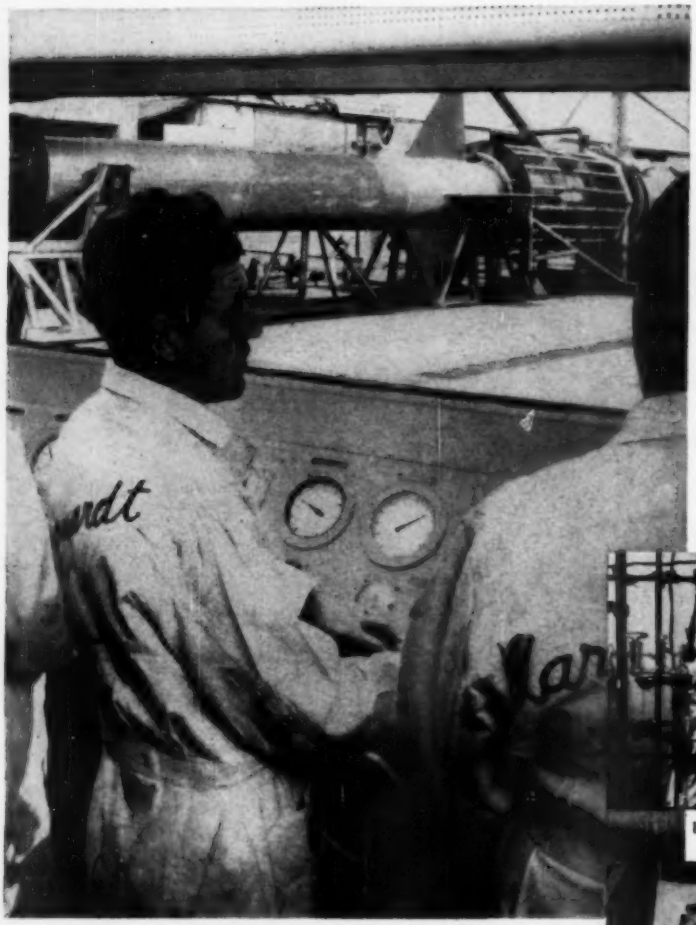
Better Power Transmission Through Better Gears

new team impetus...

speeds supersonic ramjet progress

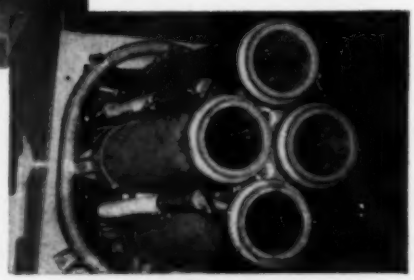


Laboratory testing of a Marquardt supersonic ramjet engine capable of producing 10,000-plus horsepower at high altitudes. Here testing facilities can simulate altitudes to 100,000 feet and air flows equivalent to three times the speed of sound. Marquardt today ranks as the West's largest jet engine research and development center for ramjet power plants. Testing is just one facet in the coordinated activities of Marquardt Aircraft Company, Olin Mathieson Chemical Corporation and Reaction Motors, Inc. dedicated to the improvement of ramjet and rocket engines and special fuels for supersonic propulsion.

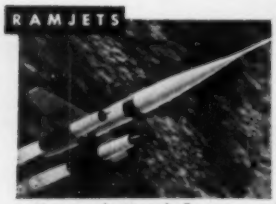
Putting the modern "weapons system" into action...that's the purpose of the OMAR Joint Technical Committee.

Here undivided responsibility in the development of supersonic aircraft and propelled missiles is a reality—from theory and drawing board, through design and engineering, to testing and full-scale production. This team activity, coordinating for the first time the chemical and mechanical experience of Marquardt Aircraft, Olin Mathieson Chemical and Reaction Motors, promises constant advancement in the development and production of ramjets, rockets, and special liquid and solid propellants of a practical nature for supersonic flight.

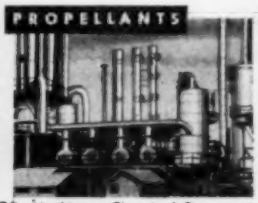
High energy fuel research at Olin Mathieson



RMI liquid propellant rocket engines



Marquardt Aircraft Company
Van Nuys, California



Olin Mathieson Chemical Corporation
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MARQUARDT AIRCRAFT
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REACTION MOTORS

OMAR

THE GOODYEAR TIRE & RUBBER COMPANY, INC., mounts the wheels of the Douglas A4D Skyhawk attack bomber on Timken bearings to get maximum strength with minimum weight.

Smallest, lightest jet combat plane ever built got that way with help of TIMKEN® bearings

DOUGLAS AIRCRAFT COMPANY, El Segundo, California, Division, builder of the A4D Skyhawk attack bomber for the U. S. Navy carrier fleet, writes us:

"To achieve the Skyhawk's engineered compactness, each of its components was selected only after the most careful consideration. Your firm, as a supplier, may well take pride in its contribution."

To help keep landing gear in this "mighty midget" A-bomber light in weight yet combat-strong, The Goodyear Tire & Rubber Company, Inc., supplier of the landing gear, mounted all three wheels on Timken® tapered roller bearings. Line contact between rollers and races gives Timken bearings maximum capacity per pound of weight. And being case-hardened, the rollers and races have hard, wear-resistant surfaces over the tough, shock-resistant cores.

The tapered construction of Timken bearings enables them to take both radial and thrust loads in any combination. Wheels are held in proper alignment, shimmy prevented.

Wear is minimized and maintenance costs reduced because friction is practically eliminated by the true rolling motion and the incredibly smooth finish of Timken bearings. Wheels accelerate quicker, insuring smoother, steadier landings.

No other bearing can offer all the advantages of Timken bearings. Specify Timken bearings, and be sure of dependable operation and long life. Look for the trade-mark "Timken" stamped on every bearing. The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".

This symbol on a product means its bearings are the best.

REVOLUTIONARY BUCYRUS PLANT HELPS HOLD DOWN RISING COSTS

At a new plant in Bucyrus, Ohio, the Timken Company has substantially reduced the cost of tapered roller bearings by: 1) producing these bearings under a new system of extreme mechanization 2) standardizing on 13 bearing sizes with the widest applications throughout industry. Manufacturers can take advantage of these lower costs by redesigning applications to use these Bucyrus sizes. And as more switch to Bucyrus bearings, product[illegible] costs can drop still further, meaning even lower costs to you.

TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS

NOT JUST A BALL ◯ NOT JUST A ROLLER ▭ THE TIMKEN TAPERED ROLLER ▭

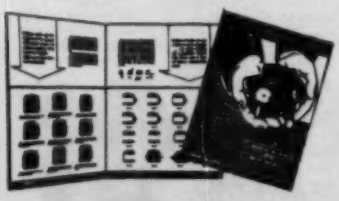
BEARING TAKES RADIAL ↓ AND THRUST →▯← LOADS OR ANY COMBINATION →▯←

YOUR No. 1 SOURCE FOR COMPLETE BELLOWS ASSEMBLIES AND DEVICES

FULTON SYLPHON

BELLOWS HEADQUARTERS, U.S.A.

You gain three important advantages when you consult Fulton Sylphon, originators of the metal bellows—*1.* Over 50 years experience in bellows engineering is focused on your problem; *2.* Modern production facilities geared to good service; *3.* Cost saving opportunities through the design and production of complete bellows assemblies.



HERE'S HELPFUL INFORMATION
This 32 page catalog covers basic bellows engineering, conversion tables, metals available and other bellows data. Use the handy coupon for your free copy.

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CONTROLS COMPANY

FULTON SYLPHON DIVISION
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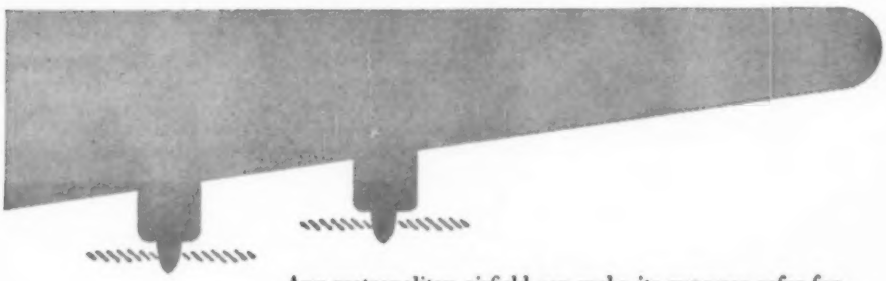

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2. CAA, in its 5 year navigation program proposal just made public, calls for 383 more VOR's and 648 additional DME's.

3. The Air Coordinating Committee, whose recommendations generally set National Air Policy, has assured DME operation for years to come. ANDB's decision earlier this year was not to *adopt* Tacan, merely to investigate its possible use in the Common System.

4. Tacan is still in a very experimental stage as a common system element. In its present form it is strictly a tactical navigation equipment. Conservative estimates say that four years would be required to re-engineer ground equipment for satisfactory civil airway use. No satisfactory design for airline or small aircraft Tacan has been demonstrated. Tacan does not provide voice communication or ILS approaches and these functions would require separate equipment if Tacan were adopted in its present form.

5. Implementation of such a system on the airways to the same level of operation as VOR/DME today would require eight to ten years. This has been confirmed by CAA, ANDB and IATA.

6. There is no argument in any quarter as to the reliability, accuracy, or dependability of present-day DME. It is recognized by all as being equally accurate as any other distance measuring system. It has been completely "de-bugged" and backed by a nation-wide service.

7. New, authorized DME approach procedures are already being published in the Airman's Guide and are being incorporated in the Jeppesen Manual as fast as released. These DME approaches permit lower minimums in many cases where terrain clearance has been a problem, reduce to a minimum let-down procedures, greatly expedite instrument operations. Australia has made DME mandatory for airline operations and pilots report DME far more accurate than older systems of using cross-bearings and even fan markers for position indication.

8. The conclusion which can be drawn by any clear-thinking aircraft user is that:

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JANUARY 30, 1956

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COVER: Field artillerymen of the U. S. 7th F. A. (rocket) Battalion in Germany load an Honest John onto its launching platform during training exercises at Grafenwoehr. Aimed by elevation and azimuth in same manner as conventional artillery weapons, the short-range missile is propelled by a solid propellant rocket charge manufactured by Hercules Powder Co.

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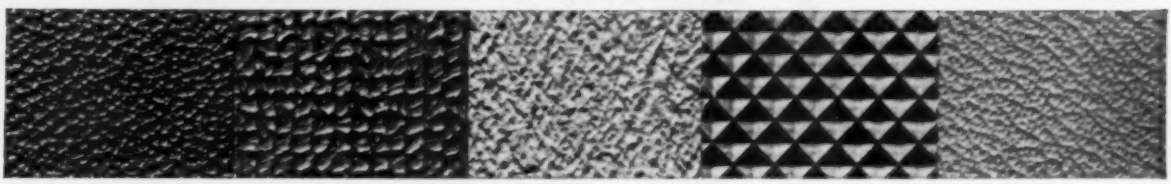

Stepped on 83,335,200 times without losing face

THIS "flight deck" is inside a B. F. Goodrich plant. It is a rough wood ramp covered by test mats of Avtrim flight rugs in 10 colors, 5 finishes. During a six-year test just concluded, roughly 83,335,200 footsteps pounded the Avtrim surface. Yet, when taken up, the face of the rug was still serviceable, the colors bright as new.

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Airpower's Year of Decision?

The balance of military airpower in the world is facing what may well prove to be its decisive year. For the last three years, Russia and the United States have been running an increasingly significant technological race to develop and produce superior aerial weapons. There is little doubt anywhere in the world that whoever wins this aerial weapons race will be able to exert enormous influence in extending its foreign policies.

During these past three years, the Russians have been rapidly increasing the pace and scope of their aerial and nuclear weapons development. During the same three years, we have been operating at a politically-limited pace pitched far below even the normal capability of our industrial and scientific resources.

Unless we reverse this "constant level" concept of development and production to accelerate the pace and expand the scope of aerial weapons development during the course of 1956, we will have made a fateful decision that will make it relatively easy for the Russians to achieve their goal of technical superiority in the air within the near future.

There is small comfort in the margin of aerial superiority we now retain. What is really significant is the relative rates of progress made by this country and the Russians during the past three years. Here the record shows clearly that the Russians are progressing at a rate much faster than our own. Virtually everyone directly concerned with the technical phase of our air weapons development program admits this grim fact. One of the most knowledgeable men in this position recently described Russia's aviation achievement to us as nothing short of "fabulous."

Fresh warnings on the Russian menace were recently made publicly by Trevor Gardner, USAF Assistant Secretary for Research and Development, and by Lt. Gen. Thomas Power, chief of the Air Research and Development Command. (AW Jan. 23, p. 31). It would be hard to find any better qualified men in the country on this subject.

In detailing Russian air progress during 1955, Gardner noted the following significant points.

"1. They (the Russians) have revealed an ever-increasing strength in total airpower.

"2. They have revealed six new types of aircraft which imply six new engine types, all of advanced turbojet or turboprop design. They have revealed these aircraft in quantities which are very substantial and indicative of great production know-how.

"3. They have revealed an airborne radar capability which implies a vast state of the art advancement in this field.

"4. Their advancement in electronics and radiation fields were corroborated by the quality and quantity of data discussed at the Geneva conference.

"5. They have indicated a substantial growth in nuclear weapons capability as revealed by their tests. The most recent test in the current series was in the megaton range.

"6. They have indicated during the year an enthusiasm for the development of advanced commercial aircraft, continuing enthusiasm for the development of guided missiles and a stated national policy concerning advanced areas of technology such as scientific satellites.

"Certainly there is nothing in this picture that leaves room for complacency, since it is clear that the Soviets are leaving no stone unturned to close the gap in this technological race."

Gen. Power, who combines the hard operational experience of the Strategic Air Command with his present technical responsibilities, adds the following significant points:

- **The Russians have drastically reduced** their development cycle and production lead time in translating new technical data into combat-ready weapons.
- **The Russians are increasing** their training program for engineering and scientific personnel at a rate that will soon surpass ours.
- **The Russians have introduced** a sharply competitive system into their aircraft development program that provides top Soviet scientists and managers with as much as 50% of their income "from a bonus system that is without parallel."

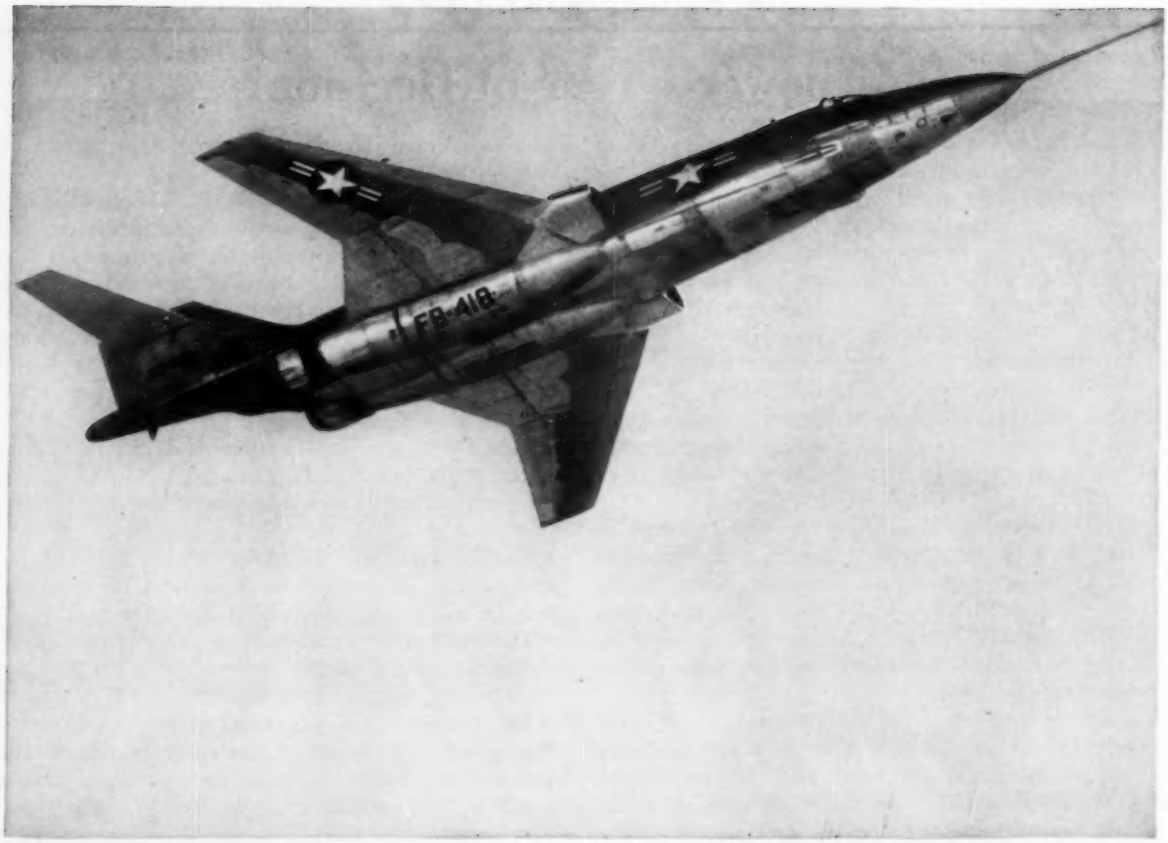
"To maintain our lead will cost money," says Gen. Power. "But if we do not face up to the reality that Russia is fast closing the gap, we may soon be outdistanced by them in the race for technological supremacy."

Here are clear, unequivocal statements on the Russian menace by technically qualified military and civilian leaders. These men have performed a patriotic duty of the highest order in presenting the details of this problem to the American people. We would like to hear an endorsement of their views by President Eisenhower and Defense Secretary Charles E. Wilson, along with an equally firm and courageous assurance that something was really being done to meet and surpass the Russian challenge in the air. So far, the only evidence on the record from the highest level official sources is the Fiscal 1957 budget proposal that will mean a stagnating or reduced effort for American military airpower in the future.

The airpower issue poses perhaps the gravest crisis in our history as a nation. Never before have we faced the possibility of total destruction from the air. The airpower issue should cut across all political ties, dissolve all inter-service rivalries and occupy the most serious attention from the American people and their leaders.

It must get the fullest public debate possible because a decision must be made before the fateful year of 1956 slips past, and we find ourselves unknowingly committed to a policy that will eventually breed defeat.

—Robert Hotz



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Dale H. Black, assistant to the president, Narmco Manufacturing Co., San Diego, Calif., formerly technical sales manager.

Joseph Frank, president, Astron Corp., E. Newark, N. J., former vice president-sales.

Honors and Elections

Dr. Charles J. Marsel, president of the New York chapter of the American Rocket Society. Dr. Marsel is associate professor of chemical engineering, New York University. New York ARS vice president is **Paul Terlizzi,** Naval Air Rocket Test Station, Dover, N. J.

Thomas P. Walker, president, West Coast Electronic Manufacturers Assn. He is vice president of Triad Transformer Corp., Venice, Calif.

James E. Sullivan, a director of Irving Air Chute Co., Inc., Lexington, Ky., former director of the Airborne Equipment Division, BuAer.

Changes

Howard K. Morgan, director of commercial aviation systems, Bendix Aviation Corp., Detroit, Mich., formerly engineering director at Bendix' Kansas City Division operated for Atomic Energy Commission.

L. W. Mullane, assistant to general manager of Rheem Manufacturing Co.'s Government Products Division, Downey, Calif.

George R. Lawrence, marketing director, Sperry Gyroscope Co., Great Neck, N. Y., formerly manager of the Air Force Department. **Gerald B. Wright,** manager of a special Hustler systems department for the Convair B-58; **Thomas W. Melia,** manager of surface systems and **Robert Lyons,** manager of air systems.

Bruce H. Pauly, associate director, research and development, Weatherhead Co., Cleveland, Ohio, handling aircraft activities.

Paul O. Momenteller, commercial sales manager, LearCal Division, Lear, Inc., Santa Monica, Calif.

Walter G. Cox, design engineer in project group, Reinforced Plastic Division, Brunswick-Balke-Collender Co., Marion, Va.

Dr. Theodor Buchhold, missile consulting engineer, General Electric Co., Schenectady, N. Y., control and guidance systems engineer in Germany during World War II.

Frank J. Martin, assistant sales manager, commercial aircraft sales, Allison Division, General Motors Corp., Indianapolis, Ind.

Allen S. Dunbar, manager, advanced technical planning department, Dalmo Victor Co., San Carlos, Calif.

INDUSTRY OBSERVER

► Navy future of the Douglas F4D Skyray supersonic fighter appears to be getting dimmer. Skyray failed its carrier qualification trials last fall. Douglas El Segundo Division is developing modifications aimed at alleviating Skyray carrier problems, but Navy is now looking to newer designs for its supersonic fighter requirements.

► **Ryan's delta wing vertical take-off research plane has made test flights at Edwards AFB using special landing gear to permit normal horizontal attitudes for both take-off and landing. The Ryan VTO is being flown by Peter Girard, the company's chief test pilot. It is powered by a Rolls-Royce Avon turbojet.**

► Scott Crossfield, famous NACA test pilot and the first pilot to reach Mach 2, has left NACA's Edwards AFB High Speed Flight Research Center to join North American Aviation as an engineer on the new rocket powered research plane designed to explore altitudes above 500,000 ft.

► **An inflatable all-rubber airplane (except for the engine and its mounting) has been developed by Goodyear Aircraft Corp. for possible use in liaison and scouting missions. The craft is easily portable and is air-inflated before use.**

► Several competitive angles have resulted from Republic Aviation's competition to select a contractor to develop the complete avionics package (fire control, navigation, communication, and flight control) for a new fighter-bomber. One of the four major avionics contenders is the Autonetics Division of North American Aviation which itself has a competing airframe program. It also marks the first attempt of another contender, the Ramo-Wooldridge Corp., to enter the airborne-systems field. The other major contenders are industry teams: General Electric and American Bosch Arma Corp., and Radio Corporation of America and Minneapolis-Honeywell.

► **General Electric's Light Military Electronic Equipment Department will be set up as second source to produce Navy Bureau of Ordnance's Sidewinder air-to-air missile, now in production at Philco. The contract will be GE's first for missile production, although the company has long been active in missile development for Army Ordnance.**

► Next step in lateral control of highspeed aircraft will be differential operation of the all-movable tail surfaces. Low moment of inertia in roll of high-speed planes makes this technique possible. French supersonic interceptor Trident, which has three tail surfaces separated by 120 degrees, uses differential tail deflection to roll the plane.

► **Northrop's F-89H, latest model of the Scorpion twin jet all-weather interceptor series, carries six Hughes Falcon air-to-air missiles in addition to its conventional rocket armament. Three Falcons are carried in each wingtip rocket pod. This armament will make the F-89H the most heavily armed fighter in USAF service.**

► American Airlines is increasing the seating capacity of its fleet of 27 first class DC-6Bs from 54 to 62 by installing eight seats in the forward cargo compartment. Modification, which is being performed by Lockheed Aircraft Service-International at Idlewild, will be complete on all planes by the end of the year. First three planes are back in the air.

► **Vickers-Armstrong is X-raying the main wing spars of all new Viscount turboprop transports as a result of discovering a two-inch fatigue crack in the wing spar of a British European Airways Viscount. Although nothing similar has been found in other Viscounts, Vickers has instituted the X-ray check as a precautionary measure after initial flight testing and prior to delivery to airlines.**

► Vickers N-113D twin-jet supersonic Navy fighter has made its first flight. The new carrier fighter, which employs boundary layer control over the flaps, was rolled out last week. It will be powered by two Avon RA29 engines developing 10,500 lb. thrust each. An earlier prototype crashed shortly after its first flight.

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Washington Roundup

Security Troubles

Military services are increasingly annoyed at Commerce Department's controversial Office of Strategic Information.

OSI was set up to encourage "voluntary" censorship by civilians of nonclassified technical information which might possibly be of use to an enemy.

But services says OSI is gaining more and more power in the field of military censorship. They feel OSI has no authority to operate there, and less knowledge, background and experience for making decisions on release of classified information.

Surprising thing about this "collision of the censors" is that military sometimes has thought it safe to talk and then been overruled by the civilian OSI.

Most exasperating difference has come over President Eisenhower's "Open Sky" plan for mutual aerial inspection of other nations' military installations.

U. S. Information Agency was told to promote the plan both here and abroad with pamphlets, photographic exhibits, and movies showing how effective aerial reconnaissance can be.

USIA's efforts had support at the very highest Government levels. Cooperation from the services was excellent.

But OSI stepped in and overruled military on release of some of its own pictures and information. Some photographs blocked by OSI had been cleared years before and published many times.

OSI apparently also used the time-proven Washington technique of having military men "investigated" when it disagreed with their decisions on release of information.

Ironically, the super-cautious OSI censors cleared one piece of photographic equipment for display even though the military thought that would break security. Military finally won that skirmish.

"If the OSI is to have authority over us," one officer said, "then let the National Security Council promulgate such a policy and we will follow it.

"But the way the situation is now, OSI is reviewing what we have already reviewed and telling us what can and can't be done with it, and we damn sight know a lot more about these things than they do.

"They are rapidly becoming a Government-wide office of censorship," he said.

Profit Policy

There is a move in the Senate for a comprehensive review of Government contract policy, including policy on profits. Sen. Albert Gore (D.-Tenn.) has urged Sen. John McClellan (D.-Ark.), Chairman of the Senate's Permanent Investigating Subcommittee, to expand his staff and undertake the project.

Gore points out that the House Armed Services Committee and the House Appropriations Committee are investigating aspects of military contracts and that various other congressional committees are investigating other aspects of contracts of other agencies. He maintains that an over-all investigation, evaluating these findings and establishing a basis for new legislation, setting a uniform policy on profits for all agencies, is called for.

Gore primarily objects to the policy of gearing contractors profits to the volume of Government business, rather than private investment. He declared:

"Although Congress recently acted to forbid the type of contract in which the contractor's fee was specifically fixed as a percentage of his costs, in many instances today the amount of his fee is still determined with an eye on the amount of Government money to be spent, rather than on the amount of capital risked by the contractor. This brings up the question of what is called advance payment. Under this practice the Government itself puts up the money used by the contractor to perform his contract.

"It is true that many negotiated contracts contain a clause ostensibly for the protection of the Government's interest, which places a ceiling on the contractor's allowable profit in terms of a specified percentage of his costs. Such a provision, undoubtedly, serves a useful purpose. But here again the allowable percentage of profit is based not upon the capital put up by the contractor, but upon the amount of Government money he handles. Whatever else may be said about such a system, I would not call it private enterprise."

CAB Search

The White House and Republican National Committee headquarters are hopeful of reaching a final decision this week on naming a successor to Ross Rizley as chairman of the Civil Aeronautics Board. First choice was retired Army Gen. Harry H. Semmes, 64 year-old Washington patent attorney (AW Jan. 23, p. 25). Gen. Semmes turned down the offer of a five-year term at CAB on the advice of his physician. The last minute rejection left the Republican Administration without a clear-cut alternate candidate and re-opened a scramble for the Board chairmanship.

Speed Rivalry

Watch for a continuation of Defense Secretary Charles E. Wilson's frustration over air rivalries between the services. Forbidden by the Pentagon boss to set official speed records, Navy first resorted to the planned "leak" to announce that the Chance Vought F8U Crusader had flown more than 1,050 mph. Now the Air Force is back, with the McDonnell F-101 Voodoo. This "leak" says it has flown faster than 1,100 mph. The next Navy play has not been disclosed, but it is a safe bet that USAF's speed-record-in-the-hole will be set by the Lockheed F-104, expected to get its first public showing some time next month.

Army Missile Policy

The Army has quietly indicated that it may eventually abandon its policy of developing missiles at its own arsenals, such as Redstone. No particular weapon was mentioned by name, but William H. Martin, Army's Director of Research and Development, said at Ft. Bragg, N. C., that he feels the design-development work on complex new weapons should be placed largely in industry. Martin realizes, he said, that this idea runs "somewhat counter to the arsenal pattern for the production and development of military ordnance." And, he indicated, there is an unresolved question of how much industry participation should be sought in the development of even the regular Army staples, such as guns and ammunition. Martin's remarks probably are the first in public to hint that technology may be growing beyond the capacity of military scientists. This is the policy followed by the Air Force.

—Washington staff

Killian Outlines Technological Program

President warns IAS of new Soviet potential; Boeing gives group details of new jet noise suppressor.

New York—A seven-point long-range program for strengthening America's technological muscle—its key to "survival in the age of technological contest"—was proposed last week by Dr. James R. Killian, Jr., president of Massachusetts Institute of Technology.

In presenting his program at the Honors Night Dinner of the Institute of the Aeronautical Sciences, Dr. Killian warned that the Russians appear to be strong in many areas where we seem to be weak. For example, he said, we face "an almost irremedial shortage of teachers as our manpower needs reach their peak." The Russians, on the other hand, appear to have achieved "a nearly adequate cadre of teachers."

Russian technology apparently operates under a master plan, defining long-range objectives, with liberal funds available for research and development, preferential treatment for scientists and impressive agility in translating ideas rapidly into hardware.

For example, Killian said the Russians can move from initial design to production of a complex weapon such as a long-range bomber in an estimated one to three years less than we can. (It took the U. S. approximately eight years to guide the B-52 from the designing board into production.)

Killian warned, however, that we must not engage in an "academic numbers race" with the Russians but must strive for maximum effectiveness in the use of our trained scientific manpower.

Killian's Program

Killian's seven-point plan covered these fields:

• **Quality.** "We must seek quality and excellence even at the expense of quantity. Our need is for better science, greater creativity, more advanced engineering, superior weapons." Above all, "Our need is for emphasis on superior scientists and engineers."

• **Education.** Secondary schools must pay greater attention to the superior student, and greater emphasis in our society must be placed on hard intellectual labor. "There has been avoidance, if not evasion, of the intellectual tax which must be paid if our intellectual budget is to be balanced."

• **Objectives.** We must better define our long-term objectives, working out a better balance between basic research and development, between fundamental ideas and hardware. "We are making only slow headway in achieving this better balance."

• **Status.** We must protect and enhance the status of the engineer and scientist. "This is more than a matter of compensation, it is a matter of status and relative prestige in the array of professions."

• **Communication.** The Government's access to our national scientific resources must be increased "by increasing the interaction between qualified members of the scientific community and officers of the Government carrying responsibilities for policy or operations affected by technology."

• **Research and development.** Government's management of research and development must be simplified, with a close look at the weaknesses of present contractual procedures and the use of short-term budgets. Excessive security, "which retards accomplishment more than it secures," must be reduced.

• **Strategy.** A thorough study devoted to "survival in the age of technological contests" should examine the factors involved in maintaining technological strength and removing roadblocks to private initiative. Such a study might become the basis for "a major document of state as well as a blueprint for maintaining America's technology as an impregnable shield and as a mighty multiplier of our wealth and well-being."

The acute shortage today lies in the supply of project engineers and men with the skills and imagination to direct research and development, Killian said, along with a lack of young engineers with a mastery of science and mathematics which would enable them to handle new technologies or enter new fields "beyond the grasp of handbook engineers."

Scientific Task Force

This is not to minimize the critical shortage in the rank and file of good competent scientists and engineers, he continued, for although the supply of "flag officers" is our major concern at the moment, "flag officers" alone are not enough to provide a strong scientific attack force.

Killian said that one way of getting more young people into engineering and the sciences is to do something about the fact that nearly 60% of the top quarter in quality of our high school graduates fail to complete four years of college. We must, he said, also shore up the sagging emphasis on science in both secondary schools and colleges and make "bold efforts to replenish the decimated ranks of science teachers—not with culls from other fields but with teachers possessing a

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This report of the Institute of the Aeronautical Sciences annual meeting was prepared by Aviation Week editors David A. Anderton, Erwin J. Bulban, George L. Christian, Robert H. Cushman, Glenn Garrison, Philip J. Klass and Henry Lefer.

Sarnoff Urges 'National Education Reserve'

Washington—A thousand of the nation's top defense industry leaders were told last week they have an obligation to help meet the technical education crisis, created in part by the fact that their wage standards attract the best talent, leaving America's schools wihout adequate teaching staffs.

Suggesting creation of a "National Education Reserve," similar to a military reserve force, David Sarnoff, board chairman of the Radio Corporation of America said his plan "would amount to the restitution by business of personnel it has siphoned off from the school system."

He added that industry should help replenish the "reservoir" of trained personnel for its own best interests. More important, however, is the fact that Soviet Russia is outproducing the United States in the training of scientists and engineers.

Sarnoff spoke at the annual dinner of the National Security Industrial Assn., where he was presented with the James Forrestal Memorial Award. President Eisenhower was the recipient last year.

Declaring that both our economy and national security will suffer unless vigorous action is taken, Sarnoff said the shortage of trained personnel will get worse unless more teachers of physics, chemistry and mathematics are provided.

He proposed that industry release a number of qualified personnel with full pay for at least a year to take teaching assignments in their local schools. In addition, he suggested that the National Educational Reserve mobilize retired technicians who would make good teachers and qualified persons willing to teach at night schools.

A five-year interim program, Sarnoff said, would help meet the immediate situation, breaking today's major bottleneck at the high school level.

for Survival

grasp of science and the preception to identify and encourage young people with the bent and capacity for science."

Success in attracting and holding more first-rate teachers will depend upon accelerating the development of more and stronger graduate programs, Killian said. The graduate school and the research associated with it can provide engineer-teachers with the opportunities for professional activities and growth that they now find chiefly in industry and government.

Industry also is putting increasing emphasis on graduate studies as weapon systems become more complex. In 1953-54, however, the number of advanced degrees granted in the engineering field was only 4,800; 4,200 master's and 600 doctor's. Killian contrasted this with the larger number in other professions. He called for a more generalized curriculum in engineering education, with more emphasis on fundamentals and with the major part of specialized training taking place in graduate courses or in-service training programs given by industry.

Most of the top Soviet aeronautical engineers, he said, teach or hold administrative posts in the top schools, relieving to some extent the need for highly qualified teachers. One example: bomber designer Tupolev is a full professor. "This kind of close coupling between practice and teaching contributes to an effective marriage of theory and practice," Killian said, but there is evidence that these multiple duties sometimes reduce teaching quality.

More Private Research

Killian also deplored the fact that the aircraft industry spends so low a percentage of its budget on basic research—only 2.4% of its research and development funds—as compared with 7% for the Government, 4% for all industry and 10.5% for the chemical industry.

He called for a "broadly conceived strategy" for maintaining the nation's technological supremacy. This would involve studies of not only manpower and education, but utilization of manpower and personnel policies of the Government, industry and elsewhere. He called for studies probing for soft spots in U. S. research and development, areas such as aircraft propulsion, metallurgy, design, fabrication and materials where concentrated massive efforts might prove dramatically successful. These studies would also examine the lag between discovery and application and look for elements of strength in Russia's technology that might hold lessons for this country.

RECIPIENTS of awards presented during the Honors Night dinner of the Institute of Aeronautical Sciences are pictured with outgoing president Robert E. Gross. They are, l. to r.: Giles J. Strickroth, Capt. Wilbur E. Kellum, USN; Gross, H. Julian Allen and Lt. Col. Robert C. Bundgaard.

IAS Honors and Elections

New York—Dr. Edward R. Sharp, director of Lewis Flight Propulsion Laboratory, National Advisory Committee for Aeronautics, was installed as president of the Institute of the Aeronautical Sciences for 1956 at the Institute's Honors Night Dinner here last week. Dr. Sharp, former IAS vice president, succeeds Robert E. Gross, president and board chairman of Lockheed Aircraft Corp.

Two honorary fellows, highest membership classification, and ten fellows were elected for 1955. American honorary fellow, an award made posthumously for the first time, was given the late Ralph S. Damon, president of Trans World Airlines. Mr. Damon died on Jan. 4. Foreign honorary fellow is Peter G. Masefield, managing director of Bristol Aeroplane Co., Ltd., England and former chief executive of British European Airways Corp.

Chosen as fellows: William B. Bergen, executive vice president, Glenn L. Martin Co.; Lars Brising, vice president-engineering, Saab Aircraft Co., Sweden; Victor E. Carbonara, president, Kollsman Instrument Corp.; Harold Luskin, chief of aerodynamics, Santa Monica Division, Douglas Aircraft Co.; Dr. Gordon N. Patterson, director, Institute of Aerophysics, University of Toronto, Canada; Kendall Perkins, vice president-engineering, McDonnell Aircraft Corp.; Raymond H. Rice, vice president-chief engineer, North American Aviation; Lewis A. Rodert, assistant to chief of research, Lewis Flight Propulsion Laboratory, NACA; Rear Adm. James S. Russell, chief of BuAer, and Prof. Hermann Schlichting, Technical University of Braunschweig, Germany.

The Sylvanus Albert Reed Award for 1955 was presented to H. Julian Allen, chief of the highspeed research division of NACA's Ames Aeronautical Laboratory, for "contributions and leadership in solving problems in the design of supersonic airplanes and missiles, especially the thermal problems at hypersonic speeds." Allen is considered an authority on the aerodynamics of intercontinental ballistic missiles.

Lawrence Sperry Award went to Giles J. Strickroth, manager, Electronics Department, Glenn L. Martin Co., for "contributions to the development of the guidance system for the Martin Matador, the first and only tactical ground-to-ground missile to be put into operation by the U. S. Air Force."

Robert M. Losey Award was given to Lt. Col. Robert C. Bundgaard, USAF, "in recognition of outstanding contributions to the science of meteorology as applied to aeronautics." He has been in charge of Project Black Sheep, a research operation that has developed techniques for forecasting weather at high altitudes for jet aircraft and has resulted in a technique for predicting minimal flight path in time and space when applied to the slowly climbing jet profile.

John Jefferies Award was presented to Capt. Wilbur E. Kellum, USN, commander of the Naval Medical Research Institute, National Naval Medical Center, Bethesda, Md., for "outstanding contributions to the advancement of aeronautics through medical research." Capt. Kellum has been instrumental in improving training and qualifications of Navy flight surgeons.

At IAS Meeting

Boeing Says Suppressor Reduces Jet Noise of 707 to DC-7 Level

New York—Boeing Airplane Co. announced last week that its recently-developed sound suppression nozzle can cut the sound level of a Pratt & Whitney J57 engine running at full throttle with water injection to that of a Wright Turbo-Compound engine in a DC-7. Boeing says this can be done without prohibitive thrust loss or added weight.

First details of the silencing program were outlined at the 24th annual meeting of the Institute of the Aeronautical Sciences by Holden W. Withington, a Boeing technical staff engineer.

A Boeing plot comparing sound propagation patterns of the two planes during takeoff shows that the 707's 90 decibel pattern is pear-shaped with a maximum width of about 4,000 ft. and extending approximately 33,000 ft. from the start of the takeoff roll. The DC-7's pattern at the same noise level is elliptical, also approximately 4,000 ft. wide but extending over 80,000 ft. from the point of the beginning of takeoff. Part of the reason for the 707's shorter pattern is the faster climb-out.

High-Speed Tests

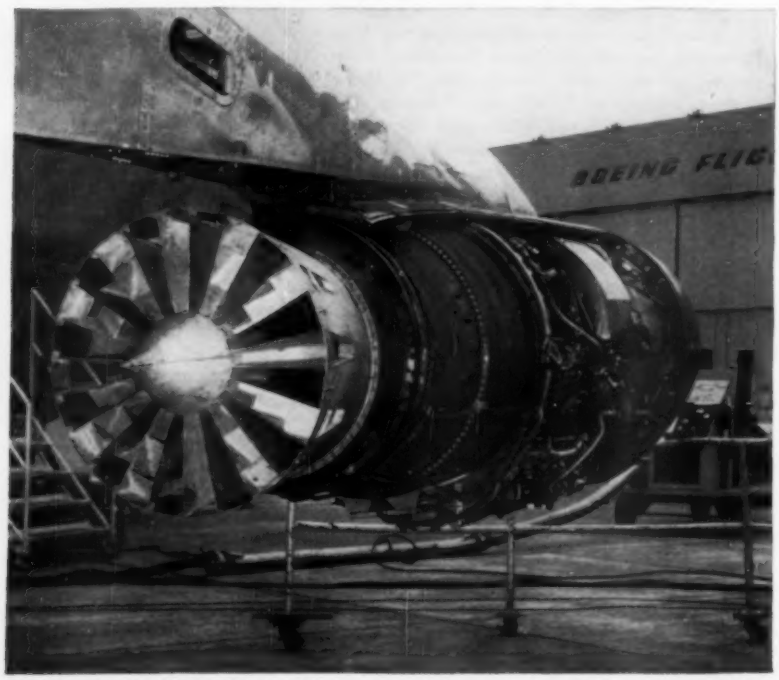
Withington said that, "While only six months ago there appeared little or no hope of reducing jet noise with any remotely practical device . . . we now have seven full scale noise suppression nozzles and more than 40 small scale nozzles which have demonstrated the practicality and effectiveness of the jet noise suppression."

Static and high-speed taxi tests using the prototype 707 already have been conducted. Flight tests will be run in the near future on the most promising configurations.

Nozzle Design

When viewed from the rear, one Boeing noise suppressor under test resembles a large metal flower with 12 squared-off, extended petals. Noise reduction is achieved by introducing a number of bars or wedges into the jet engine's exhaust stream. These create a turbulence that quiets the roar of the exhaust.

Boeing found that noise reduction grew with deeper corrugations or increased periphery at the nozzle exit. This led the company to design nozzles with increased peripheries. More bars and wedges also were added to increase even more the turbulence in the jet exhaust.



BOEING SOUND SUPPRESSOR undergoes test attached to Pratt & Whitney J57 engine of 707 transport. Boeing says suppressor reduces jet noise to that of Turbo-Compound.

Maximum sound reduction obtained with the Boeing devices, Withington said, is 35 decibels in the 75-600 cycles-per-second frequency range. The majority of the nozzles achieved reductions in frequency ranges up to 2,400 cps., while one gave significant reductions up to 9,600 cps.

Actual tests of the nozzles showed maximum noise reduction up to 15 decibels overall and 20 decibels in the lower frequencies. Boeing is encouraged by the greater attenuation of the low frequencies because distance and buildings tend to give greater attenuation to higher frequencies not suppressed by the nozzle.

Noise level of a standard, conical nozzle gives a static noise pattern with the maximum at an angle of 35-40 degrees from the jet axis. Most of the Boeing sound suppression nozzles, therefore, have been designed to give maximum noise attenuation in this direction to provide a noise pattern whose shape is more nearly circular than that of a conventional conical nozzle.

Thrust Coefficient Tests

A principal cause for poor thrust coefficients with noise suppression nozzles is caused by the extension of the corrugations down to the center plug, which results in flow separation from the surface of the plug. Boeing believes that it is possible to eliminate this separation by proper plug shape and by tailoring the nozzle shape at the plug. Additional nozzles to correct this deficiency are now being built.

Thrust coefficient test results varied, Withington said, according to the type of nozzle tested. Some showed essentially no loss up to pressure ratios of 2.5, then fell off to a loss of approximately 1% at a pressure ratio of 4.

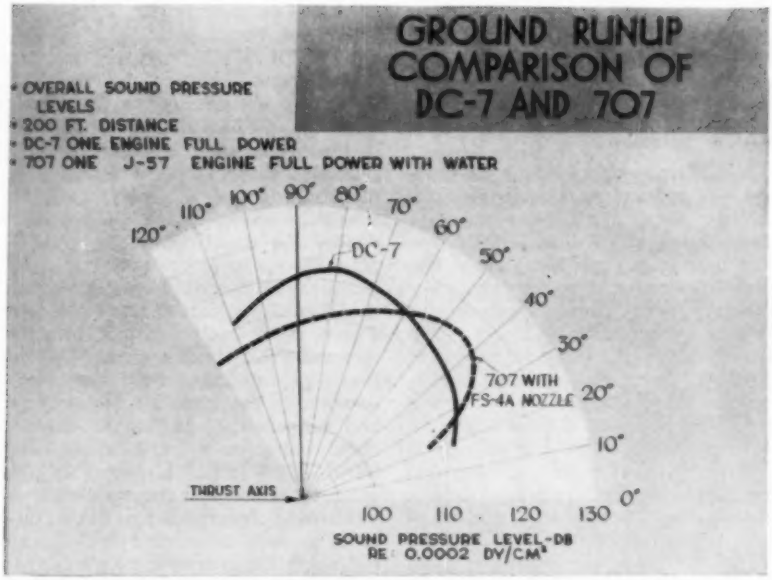
Others showed a loss of 6%, half of which was due to plug separation.

Weight Considerations

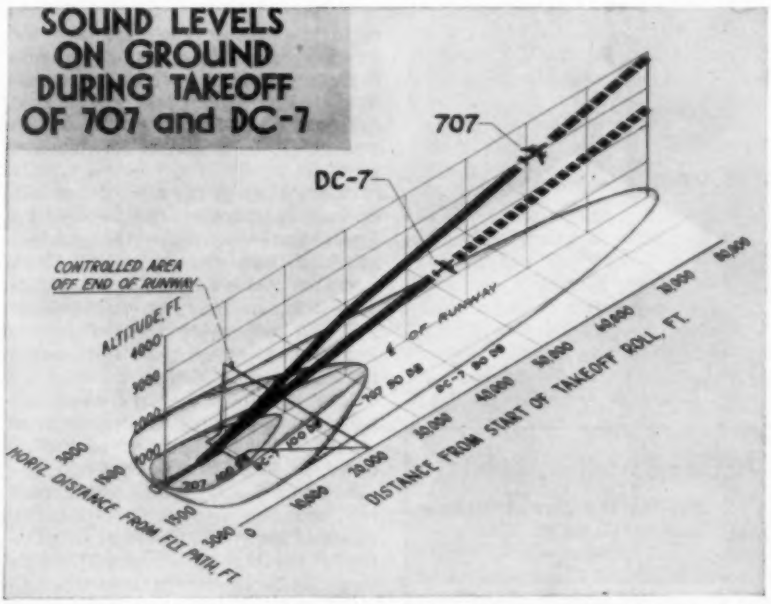
Boeing concedes that much development lies ahead before a sound suppressor nozzle with a life equal to standard units can be achieved. Current nozzles are boiler-plate test items, and weight is on the order of 100 lb. per nozzle. These noise suppressors have not been cleared for flight tests.

There are two considerations which benefit the sound suppression nozzle:

- **Reduced wing weight.** Experience with B-47s and B-52s shows that major structural problems exist in wing trailing edges and flaps which are caused by acoustical environment. Tests with the sound suppression nozzle show that its use reduces noise by 17-19 decibels in the lower "structurally critical" frequencies (150-1,200 cps.) at two positions in the wing. This reduction in acoustical excitation is equivalent to a thrust reduction of approximately 50%.



BOEING CHART SHOWS GROUND RUNUP comparison of 707 and DC-7. The noise level for both aircraft is almost identical, slightly more than 120 decibels.



PLOT OF SOUND LEVELS on takeoff of Boeing's 707 jet transport and Douglas DC-7.

The result is a possible reduction in wing weight or lowered maintenance in these areas.

• **Less sound proofing.** Noise reduction resulting from the nozzle may mean a lighter fuselage because of less cabin sound proofing. Thus, the net weight increase resulting from the nozzles may not be as extreme as appears at first glance.

As Withington pointed out: "The ultimate compromise for any particular airplane will be dependent on time, economics and the continued technical improvements in noise suppression . . . one thing is certain from the results of the program so far—we can make noise reductions in jet aircraft without serious penalty to the aircraft's performance."

Withington said that Boeing made use of all available background material, including that on work done by Rolls-Royce's F. B. Greatrex and Pratt & Whitney Aircraft's John Tyler.

The Greatrex noise suppressor is a series of "teeth"—metal extensions placed around the tailpipe's rim (AW July 6, 1953, p. 28). Tyler's design is understood to use multiple nozzles.

IAS Missile Session Stresses Reliability

Liquid rocket engine reliability in flight tests now stands at a high of better than 90%, according to T. J. Keating, of Wright Air Development Center. He said that the improvement in reliability of such engines over the past years has been the most interesting of all.

USAF is seeking 100% reliability in its missile program. Solid-propellant rockets, in the current state of development, show such high reliability that designers are being urged to use them if at all possible. For example, said Keating, in all the hundreds of thousands of Rato firings since the end of World War II, there have been less than ten reported failures and only one fatality.

Pointing out that ramjet engines really begin to pay off above Mach numbers of two, Keating said that in production the ramjet engine would be expected to cost about one-twelfth that of a turbojet which could do the same kind of job.

Missile Guidance Systems

Three basic categories of missile guidance systems were discussed by Col. R. C. Gibson, of the Air Research and Development Command. "Reliability is receiving considerable attention and remains a serious challenge to the designer.

"There may be a point of diminishing returns in the investment of additional money in improving reliability in an already expensive missile; but few, if any, missile engineers would venture to suggest that the optimum point has been reached.

"There remains considerable advantage in 100% inspection of missile vacuum tubes to arbitrary mechanical and electrical specifications more stringent than MIL E1B, the official specification for tubes," Col. Gibson said.

In a summary of the USAF guided missile program, delivered by Capt. R. W. Dillon, of Headquarters, Air Research and Development Command, it was pointed out that the Air Force is developing several kinds of missiles, and that tests have been encouraging.

Earth Satellite Program

Four papers on the satellite program and its relation to the work to be done during the International Geophysical Year were presented during the annual meeting.

No new details of the Project Vanguard were told during the presentations.

A summary of the current state of hardware and contracts for the launching vehicle—a three-stage, liquid-propellant rocket—will be found on p. 37.

Supersonic Area Rule

An extension of the area rule to supersonic applications highlighted the aerodynamic sessions of the IAS meeting. Harvard Lomax of NACA's Ames Aeronautical Laboratory reported on the work done by him and Max Heaslet, also of Ames, on the mathematical derivation of the extended concept.

Lomax credited both Robert T. Jones and Richard T. Whitcomb of NACA with suggesting the supersonic application of Whitcomb's area rule right after its value as a transonic tool had been discovered. Basic technique in extending the application of the rule is to consider area distribution on planes inclined to the thrust axis at the Mach angle, rather than at right angles as in the transonic case.

The usual assumptions of slender bodies, zero-lift conditions and neglect of viscous effects were made. The supersonic application is limited to low lift coefficients.

In discussion following Whitcomb's presentation of the physical basis and application of his area rule (AW Sept. 12, 1955, p. 12), these new details were emphasized:

- **Area rule applies equally well** for a straight wing-body combination, although all the published data were based on swept wing and delta wings. But the effect of the area rule washes out on straight wings above Mach 1.4.
- **Transonic area rule** is limited to flight conditions below lift coefficients of approximately 0.4. Above this value, the benefits begin to vanish.
- **Internal flow area** is subtracted in preparing the area diagram. This is done by subtracting the inlet area all along the fuselage. But the exit area is generally greater than the inlet; to compensate, a simple cylinder whose cross-section area equals the difference between inlet and exhaust is added from the exit aft.

VTOL Design

Higher thrust-weight ratio turboprop engines are needed to improve the state of the VTOL art, three experts told delegates to the VTOL session of the IAS annual meeting.

But new powerplant packages must satisfy two widely divergent conditions. For the VTOL or slow end of the flight regime, there must be a high static thrust-weight ratio to accelerate the craft off the ground, interconnected shafting on multi-engined planes for safety and bleed flow from either compressor or exhaust for boundary layer and flight control.

For highspeed cruise, the powerplant package must have high overall propulsive efficiency.

The development programs which could satisfy these needs have been split: large-diameter, slow-turning rotor systems have been aimed at the first requirement and small-diameter, high-speed turboprop systems at the latter.

NACA Solution

NACA's paper solution to the problem was redesigning a large diameter propeller for as much improvement in static thrust as possible, without unduly hurting the propeller's cruise efficiency.

Bell Aircraft Corp.'s approach was ducting a more normal-sized propeller in a shroud which could be altered in geometry for each condition. This, Bell said, will increase the efficiency 25% while it lowers the noise 50%.

Motion pictures of Bell's twin jet VTOL test vehicle have documented the belief that the state of the art can provide designers with at least marginal powerplants and control methods for VTOL and for the transition from VTOL to forward cruise in the air. Although the motion pictures indicated that "nervous" pilot stick motions were mandatory, the three variable-direction control jets (15-45 lbs. thrust) stabilized the craft during vertical flight and in that part of the transition to conventional forward flight before airspeed allowed the use of the conventional control surfaces.

STOL-VTOL Combination

Backers of the no-runway VTOL transport claimed that the short runway STOL (short take off and landing) was only a partial solution to the growing airport, population center and military mobility problems. It was admitted that the STOL was more comparable to conventional craft in payload and range. What is needed, said J. A. O'Malley of Bell, is not a tail-sitter VTOL or the high wing-lift STOL but a STOL/VTOL: a type which has the inherent capacity to trade a VTOL's complete freedom from runways for STOL's better range and payload if and when a short runway is available. Bell's proposed design is a conventional type airplane with twin wing-tip propellers which rotate to the vertical for direct thrust on vertical take-off.

Fairchild Aircraft Division design, described by chief engineer Walter Tydon, favors incorporation of the wing into the STOL force system. NACA's free flight models showed how combinations of slats, flaps and tilting wings and propellers could enable conventional transports to perform not only STOL but VTOL. However Fairchild appears to think that the more extreme mechanical contortions which a STOL must go into to achieve VTOL are not worth the ground space gained.

Internal Engine Flow

As aircraft with internal through-flow propulsive systems move into higher supersonic Mach numbers, the internal engine flow becomes progressively more important than the external flow. Future fighters may use radically different inlet and nozzle shapes with a much greater degree of variable duct geometry.

Above Mach 2, the use of inlets with internal contraction compression becomes worth overcoming the problems associated with them, stated H. Drell, Lockheed Aircraft. The advantages are a 20-50% gain in net propulsive thrust and a 20-30% added range. The problem is how to establish and control the internal shock pattern.

If a supersonic aircraft's nozzle design is not integrated with the external afterbody flow, interaction of the internal jet flow with the external flow may set up shock patterns which result in severe performance penalties, claimed NACA's E. Cortright Jr. Taking a number of mechanical nozzle types Cortright showed how the high speed in-flight net thrust result could be quite different from that predicted by non-integrated studies.

Guggenheim Medal

Dr. Theodore von Karman, chairman of the Advisory Group for Aeronautical Research and Development of NATO, received the Daniel Guggenheim Medal for 1955 at the Institute of the Aeronautical Sciences Honors Night dinner.

Von Karman received the medal ". . . For long-continued leadership in the development of aerodynamic theory and in its applications to the practical problems of flight; in education in the aeronautical sciences; and in stimulating international cooperation in aeronautical research."

Von Karman is perhaps best known to the current generation of aeronautical engineers for his pioneering work in supersonic aerodynamics during the past 20 years. Much of von Karman's influence in that field shows in today's aircraft designs.

Contoured Avionics

The best solution to the problem of cramming more and more avionics equipment into less space in future military aircraft may lie in providing equipment in the form of a group of small modules, without chassis case, shock mounts, power supply or cooling provisions. The airframe designers can then integrate these into a form factor which fits the contour of the aircraft.

This suggestion, made by R. J. Henderson and G. P. Allison of Glenn L.

Martin Co., included the recommendation that a suitable authority be set up to work out the standardization of module sizes.

Advantages of this approach to avionic equipment design, cited by Henderson and Allison, include:

- **Maintenance and logistics** problems would be simplified, because most of the replaceable modules would be standard between different aircraft.
- **Design and production** of equipments for new aircraft could be speeded.
- **Airframe manufacturers' engineers,** who know the space and environment in which the equipment must operate, would be responsible for planning its installation, providing a common power supply, and furnishing the necessary cooling air, from a common source.

Manufacturers that are turning to this type of modular construction, according to Henderson and Allison, include: Collins Radio, Bendix Radio, Eclipse-Pioneer, Hoffman Electronics, Federal Telephone and Radio, General Electric and Stromberg-Carlson.

Effect of Electronic Loads

Electric power generated in the largest World War II aircraft was supplied by four 6 kw. generators, drawing only 40 hp. from the engine, whereas current civil and military aircraft now require four 60 or 90 kva. generators, draining 360 to 540 hp. from the engines. These figures were cited by Henry Rempt and M. J. Cronin of Lockheed, to show the impact of growing avionic equipment on electric generator design and aircraft power plants.

Airborne early warning aircraft, such as the Lockheed WV2, have a total avionic load of approximately 14.5 kw. of d.c. power and 25 kva. of a.c. power. An F-94C interceptor requires 10 kw. of d.c. and 1 kva. of a.c. for its avionics equipment, plus another 30 kva. for de-icing, the authors reported.

A report on the status of Common System navigation aid development, and possible future trends, presented by James L. Anast of the Air Navigation Development Board, will be the subject of an AVIATION WEEK article in a subsequent issue.

Common System

H. I. Rothrock, special assistant to the head of the Air Navigation Aids Branch of Naval Operations, told delegates to the IAS meeting last week that Navy's specialized requirements rule out its use of the present Common System of Air Navigation aids and control facilities.

Rothrock said that Naval aircraft, basically designed for sea-based operations, cannot possibly carry the various airborne components required in both the tactical and Common System.

Performance of high-speed naval aircraft is another reason why the inadequacies of the existing system of civil air traffic control have caused serious delays to military flight operations within the United States, Rothrock said.

He called complete integration of the Common System to meet both military and civil needs "mandatory" and said it "vitally affects the defense of the country."

Commenting on two developments which have been mentioned for air traffic control use—VOLSCAN and SAGE—Rothrock called safety only a "by-product" of VOLSCAN's traffic scheduling function and cited the need for human monitors to provide the element of safety in VOLSCAN operations. Of SAGE (see page 46) he said the highly complex system was designed to do a special job and will not be applicable to traffic control problems without "extensive modification."

LT. GEN. J. M. GAVIN Army chief of research and development inspects Redstone model.

Redstone Missile Range Comparable to V-2

Latest addition to the Army's arsenal of tomorrow's weapons is the two-stage Redstone surface-to-surface missile, now ready for production at Chrysler Corp.'s jet engine plant in Detroit.

Layout shows Redstone to be, essentially, a large liquid-propellant booster unit which launches the second stage rocket containing the warhead.

This concept differs considerably from the original plan of Redstone, conceived by ex-German scientists then at Ft. Bliss, but now at the Army's missile development center, Redstone Arsenal, Huntsville, Ala.

Indication of the size of the new weapon is given by the service platforms and tower which appear to be about 80 ft. high.

Redstone has been under development in one form or another for ten years. The range is comparable to that of the German V-2, used in combat operations in World War II, more than 11 years ago.

Republicans Are on Defensive As Budget Debate Time Nears

By Katherine Johnsen

Washington—Congressional debate on the Fiscal 1957 military budget is expected to closely follow party lines.

Democrats will object that adequate emphasis hasn't been put on guided missiles and advanced aircraft, that the administration has followed an "economy first, defense second" course, and that Defense Department's "businessman's administration" has indulged contractors with fat profits.

Republicans are on the defensive.

Military subcommittee of the House Appropriations Committee headed by Rep. George Mahon (D.-Tex.) promptly started closed-door hearings, which will run daily for at least three months. The first development was a heated clash between Rep. Clarence Cannon (D.-Mo.), chairman of the Appropriations Committee and an ex officio member of the subcommittee, and Secretary of Defense Charles E. Wilson.

Cannon complained that Wilson "dodged and squirmed and didn't answer" when he quizzed him on comparative U. S. and Soviet military strengths. Cannon said, "He was most uncooperative . . . the information I sought certainly should be known to Mr. Wilson. I imagine everybody in the Pentagon knows it."

Wilson "Dodging"

Following sessions with Wilson, Adm. Arthur Radford, chairman of the Joint Chiefs of Staff, and other over-all Defense spokesmen, the subcommittee will break up into three groups to consider Army, Navy and Air Force programs concurrently. The chairmen of these groups are: Air Force, Mahon; Navy, Rep. Harry Sheppard (D.-Calif.); and Army, Rep. Robert Sikes (D.-Fla.).

Congressional members are reluctant to pass judgment on the military budget and program until they have been briefed on it and studied it. However, these developments can be expected:

- **Emphasis on guided missiles** and advanced aircraft. Democratis are skeptical that the administration has not put enough "push" behind these programs.
- **Saving the taxpayers' money.** Both Democrats and Republicans favor this, but with different approaches.
- **More Air Force funds.** A congressional increase in the President's over-all $15.4 billion request for new money for USAF now appears to be out of the question.

Announcing the opening of hearings, Mahon declared: "I think we must face up to the possibility that Russia may be ahead of the U. S. in the field of guided missiles and in the race for the development of the intercontinental ballistics missile—the most dangerous weapon on the horizon today. Military experts assert that when perfected, it would be capable of carrying an atomic warhead and would travel at such fantastic speeds there would be little or no defense against it.

"One of the prime purposes in our hearings will be to seek ways to expedite the missile program.

"Recent technical breakthroughs made by our armed forces and scientists have improved the missile program and enhanced the possibility of making the IBM a reality.

"I am also concerned over the Department of Defense request for 800 less aircraft for the next year than Congress granted last year."

Procurement Attack

Democrats argue that substantial savings can come from stricter policies on procurement contracts. Since Mahon announced a "gloves off" attack on the earnings allowances on military contracts, particularly in the aircraft and electronics fields last May (AW May 23, p. 17), investigators have made comprehensive studies which will be used in the hearings now underway.

Rep. Jaime Whitten (D.-Miss.) estimated last week that the Defense Department could get the same procurement for 20% less.

Republicans maintain that by cutting out the unessential and emphasizing the essential, the administration program is economically achieving adequate military strength. On the opening of hearings, Rep. Harold Ostertag (R.-N.Y.), a member of the House Military Appropriations Subcommittee, declared:

"Today we have a President and Secretary of Defense who are shaping our military policies to meet the needs of today and tomorrow rather than yesterday.

"The military have often been criticized for preparing for the last war, rather than the next one, and history has often proved the charge correct. . . . Fortunately the President and his advisers are not. . . . They are strengthening the country's defenses so that no one will misconstrue our pursuit of peace as a confession of weakness. And they are doing it with hardheaded respect for the citizen who maintains our Government and supplies the money to sustain it."

Budget "Too Big"

Both Cannon and Mahon have declared that the President's over-all budget is too big and that they intend to make cuts. In addition, appropriations mean little if the money isn't spent, and the amount to be spent is up to the administration.

There is Democratic criticism of the administration for holding down expenditures and new contract-letting in USAF's aircraft and related procurement. The members of the Appropriations Committees of House and Senate—Republicans and Democrats—directed last year that USAF procurement "be accelerated to the extent possible consistent with proven technological developments and efficient application of appropriated funds."

If it appears certain that USAF will wind up this fiscal year, June 30, with a substantially larger balance of unobligated funds for aircraft procurement than contemplated in the President's Fiscal 1957 budget, Congress may well cut the new money request. This would not mean a program reduction. It would be a matter of re-scheduling.

The attitude of Congress on additional funds in specific areas—such as guided missiles or research and development—will depend almost wholly on the position taken by USAF's Chief of Staff, Gen. Nathan Twining.

B-52 Wings Scheduled

U. S. Air Force will convert its first B-36 heavy bomber wing to the Boeing B-52 long-range jet bomber in April, starting with the 42nd Heavy Bomb Wing at Loring AFB, Me.

Full replacement of the Strategic Air Command's piston-powered heavy bombers will take several years. As the B-36's are retired, USAF said, they will be cannibalized and used as a source of spare parts for aircraft remaining in service.

USAF now has one B-52 wing at Castle AFB, Calif. It formerly was equipped with Boeing B-47s.

F-100's to Europe

Air Force has begun a six-month program of converting fighter units at European bases from F-86 Sabres to F-100 Super Sabres.

The first flight of F-100s, first of the supersonic century series to be assigned abroad in strength, will go to Strategic Air Command's 45th Fighter Squadron in North Africa.

Because of the excellent flying weather there, the 45th will serve as a training squadron for pilots of other units.

Defense Cuts USAF Budget $1-2 Billion

By Claude Witze

Washington—Pentagon discipline forbids the Air Force from disclosing how much money it originally sought for Fiscal 1957, but competent estimates run from $1 to $2 billion higher than the $16.5 billion the administration requested (AW Jan. 23, p. 26).

Defense Department made sharp reductions to keep expenses below the $35.5 billion ceiling set by Secretary Charles E. Wilson. USAF is understood to have suffered at least a 10% reduction in the funds sought for day-to-day operations and maintenance. In addition, it is reported, there will be 400 fewer planes ordered than the command believes necessary.

Perhaps the greatest certainty, regardless of which service was hardest hit by Defense pruning, is that the entire issue of political forces being used to shape a military budget is headed for hot debate.

Good Case, Poor Cause

By strange coincidence, it is a former Army Chief of Staff who has drawn the battlelines. He is Gen. Matthew B. Ridgway, who has the White House and the Pentagon waiting with trepidation these days for each new issue of the Saturday Evening Post. Gen. Ridgway has a good case, but a poor cause.

His opinion of the trends manifested by the present administration was put succinctly last week in the second chapter of his memoirs:

"The gentlemen who accept these great posts of authority and responsibility in the Defense Department should be as completely divorced from politics as is humanly possible.

"I think the tendency . . . of civilian secretaries making military decisions on a basis of political expediency, constitutes a danger to this country.

"The power that is vested in the civilian secretaries, particularly in the Secretary of Defense, is so enormous that it could do incalculable harm if applied on a basis of what is good for the party instead of what is good for the country."

A week earlier Gen. Ridgway had put himself in direct conflict with some of the most important people in Washington over the question of whether he did or did not endorse the 1955 military budget when he was serving as Army Chief of Staff.

There are two unfortunate things about this controversy and neither one of them involves what was a burning issue in the spring of 1954. They are:

• **Gen. Ridgway's memoirs** have the effect of arguing for a bigger standing Army in 1956, when the threat of Soviet aeronautical and nuclear advances have added imperativeness to the Air Force program. There is danger that the Ridgway charge will be a red herring, diverting attention at this crucial time from the speed of Russian progress. The Army's budget does not appear to be a hot issue this year.

• **1955 budget.** Because he was Chief of Staff when it was being considered, this is about the only subject on which he has been quoted. You wouldn't know it from reading the papers, but Gen. Ridgway's remarks included the 1957 Defense Department budget. This is the one that went to Congress only a few days before his story appeared.

Here is his complete comment:

"The fact is the 1955 budget was a directed verdict, as were the Army budgets for 1956 and '57.

"The force levels provided in all three were not primarily based on military needs. They were squeezed within the framework of preset, arbitrary manpower and fiscal limits, a complete inversion of the normal process."

In the light of this statement, consider the fact that the 1957 Air Force budget was drastically cut by the Defense Department before it was sent to Congress.

And consider the fact that Gen. Nathan F. Twining, USAF Chief of Staff, has asserted he shall "support the budget that is before the Congress."

Politico-Military Line

If Gen. Twining today faces the situation that Ridgway faced in 1954 he has, the latter says, learned the decisions of the Defense Department are based on "considerations other than clear-cut military needs . . . on budgetary considerations, on political considerations, on the advantage to be gained in the field of domestic politics by a reduction in military expenditures."

Another thing that Gen. Twining may have learned, and there is evidence that it was known by his predecessor, the late Gen. Hoyt Vandenberg, is that he is not expected to present his "reasoned military judgment" to Defense Secretary Wilson.

"On the contrary," according to Gen. Ridgway, "incessant pressure was brought to bear on me to make my views conform to a preconceived politico-military party line . . . no matter how strongly my views might differ from those of higher authority, it was not expected that I would let my nonconcurrence publicly be known."

From the statement of Gen. Twining that he will support the Fiscal 1957 budget it might be suspected that he is in the position occupied by Gen. Ridgway in 1954. There are competent Pentagon observers, however, who do not go along with this thesis.

In addition to the fact that Russian technologists are breathing down our necks with flames unheard of in 1954 and that Mr. Wilson still believes are not hot, there is the whole question of combat capability in USAF.

Maintenance Lack

After a good deal of prodding, USAF —which may be forbidden to have views differing "from those of higher authority"—has admitted that many of its newest aircraft are grounded for lack of skilled maintenance.

Confirming an AVIATION WEEK report from Foster AFB, Tex. (AW Dec. 19, p. 14), Pentagon sources now say this applies especially to the North American F-100 Super Sabre.

It also applies to a lot of other planes, and new arrivals of "century-series" fighters on bases of the Tactical Air Command are not going to ease the strain. It will get worse.

In the face of this, and possibly to "conform to a preconceived politico-military party line," the Defense Department cut USAF's request for funds.

Gen. Ridgway indicated in his memoirs that he kept his mouth shut when he faced a similar situation, is opening it in 1956 only to keep the record straight.

Ridgway's version of what happened in 1954 is supported by neither Mr. Wilson nor his old commander-in-chief and former Army colleague, President Eisenhower.

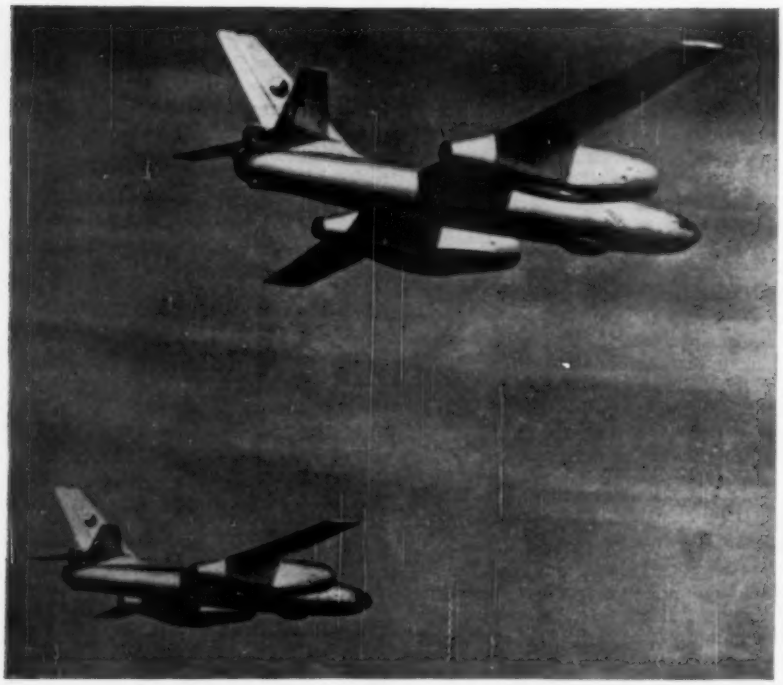
The Defense Secretary says "I certainly didn't think I was powerful enough to pressure anyone" when Gen. Ridgway was Army Chief of Staff.

When the second Ridgway article appeared, Mr. Wilson said further that "it is a new one for someone to accuse me of being a politician."

President Eisenhower says he has not read the Ridgway article. This makes him one of the few literate men with even a modicum of interest in military affairs who have missed it.

So far, nobody has asked Gen. Twining about the Ridgway story and there is no good reason why he should express an opinion. His declaration that he will support the budget does not close the door to the possibility that he will give all the details on USAF's plight when questioned on Capitol Hill.

Gen. Vandenberg told his version of the story and did it with some vehemence. Certainly there are senators and congressmen, including a former USAF Secretary, Sen. Stuart Symington, who will give Gen. Twining a full opportunity to do likewise.



Twin Butchers

Ilyushin 26 (NATO code, Butcher) light bombers such as the two shown above are being delivered to the Czech air force by their Russian manufacturers in increasing numbers. The Ilyushin's performance is comparable to that of the Martin B-57.

Defense Warns of Great Increase In Military, Civil Jet Fuel Needs

Washington—Defense Department has warned the petroleum industry that meeting jet fuel requirements "probably will be one of our greatest problems in the future."

Even if war does not come, military jet fuel needs will increase from 231,000 barrels a day now to 340,000 barrels a day by Fiscal 1965, USAF Brig. Gen. Will W. White told a National Petroleum Council meeting here last week.

Gen. White, retiring staff director of the department's Petroleum Logistics Division, discussed all distillates (jet fuel grades JP-4 and JP-5, all grades of diesel fuels and grades 1 and 2 burner fuels, kerosene and solvents), but he gave most of his attention to jet aircraft and missile needs.

In addition to increasing military demands, civilian jet fuel requirements will increase from about 12,000 barrels a day now to about 70,000 a day by Fiscal 1965, Gen. White said.

Although this will put a total demand on industry of about 410,000 barrels a day, Gen. White said he is certain that the military and the petroleum industry, "working together as we have in the past, will be able to surmount the problem—no matter how difficult or how formidable it may seem at the moment."

Standardization Necessary

Standardizing military and civilian jet fuel specifications, "at least to the extent that commercial jet aircraft be designed to operate on military fuels if the need arises," would be a major step in the right direction, he said.

"Jet engines consume a tremendous amount of fuel," Gen. White said. "Some of the larger U. S. military aircraft, powered by jet engines consume more than 2,500 gallons in one hour. This amount of fuel would take the average passenger car around the world one and one half times.

". . . In wartime, the total free world jet fuel requirement could increase to between one and two million barrels per day, if there were a long-drawn-out conflict in which supersonic jet aircraft were used extensively. This would be more than 15% of the total free world petroleum requirements of all petroleum products."

Although JP-4 is the predominant fuel being used by the military now, supersonic aircraft and some supersonic missiles require a heavier fuel which Gen. White called a "JP-5 type fuel."

The Navy is planning to use a JP-5 type aboard carriers, because its high-flash point allows it to be stored in unprotected tanks, and it can be mixed with aviation gas to produce a JP-3 or JP-4 type fuel, he said.

Another problem, putting an even greater limitation on availability of JP-5 type fuel, "is the need for high temperature stability"—now the subject of "extensive research work" both in the military and in industry.

"Based on progress to date, there is considerable concern as to whether the refining industry would have sufficient appropriate processing capacity to produce, under war emergency conditions, the required volumes of this JP-5 type fuel which would meet the high temperature stability specification limits needed," Gen. White said.

Refining Capabilities

Civilian jet requirements pose another question, he said. Available refining facilities can produce considerably more JP-4 fuel of the gasoline type than of the heavier types such as kerosene, JP-1 or JP-5.

Military specification limits are a "compromise between performance and the wartime availability," while civilian spec limits "are generally a compromise between price, performance and safety characteristics," Gen. White said.

Since an emergency would make standardization essential, and since commercial jet demands are just coming into being, "It would seem prudent to provide for such standardization now," he said—at least to the point of designing commercial jets to operate on military fuels if necessary.

The military is "acutely aware of the potential shortages of distillates in an emergency," Gen. White said.

It is gearing performance demands in improved military engines to availability of fuels under emergency conditions, and considering competing demands for other military and civilian fuels now.

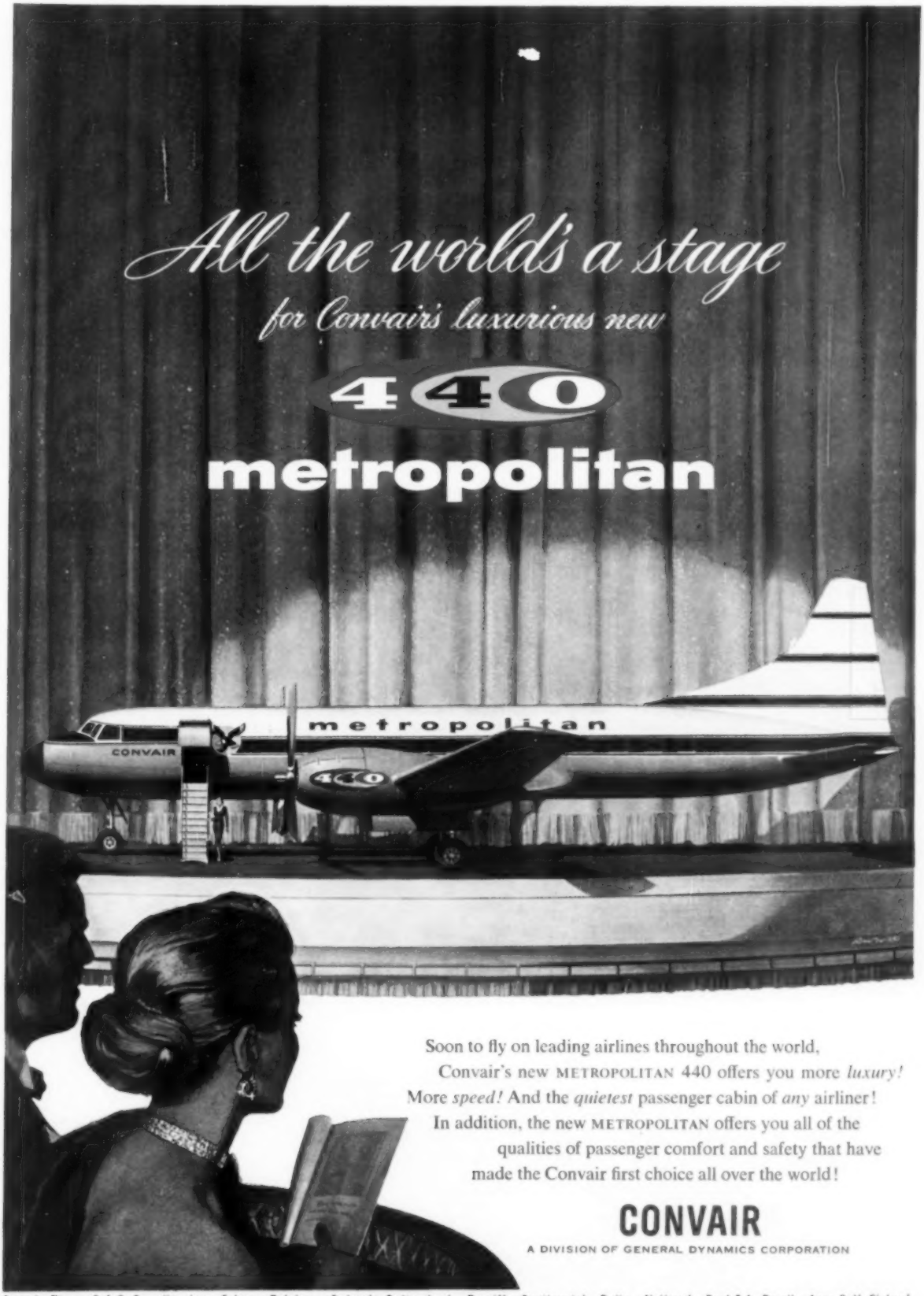
"For this reason JP-4 fuel was substituted for JP-1," Gen. White said. "The Navy recognizes that JP-5 is the best fuel for its purposes, but is using it only aboard aircraft carriers where it is essential.

"The Army realizes the many advantages of dieselizing all its mobile equipment but, due to the expected shortages of distillates, it has limited dieselization to specific types of combat equipment.

"Further, this Army policy directs that present use of diesel power . . . be reviewed, and every effort made to convert to gasoline."

Picture Credits

27—Wide World.



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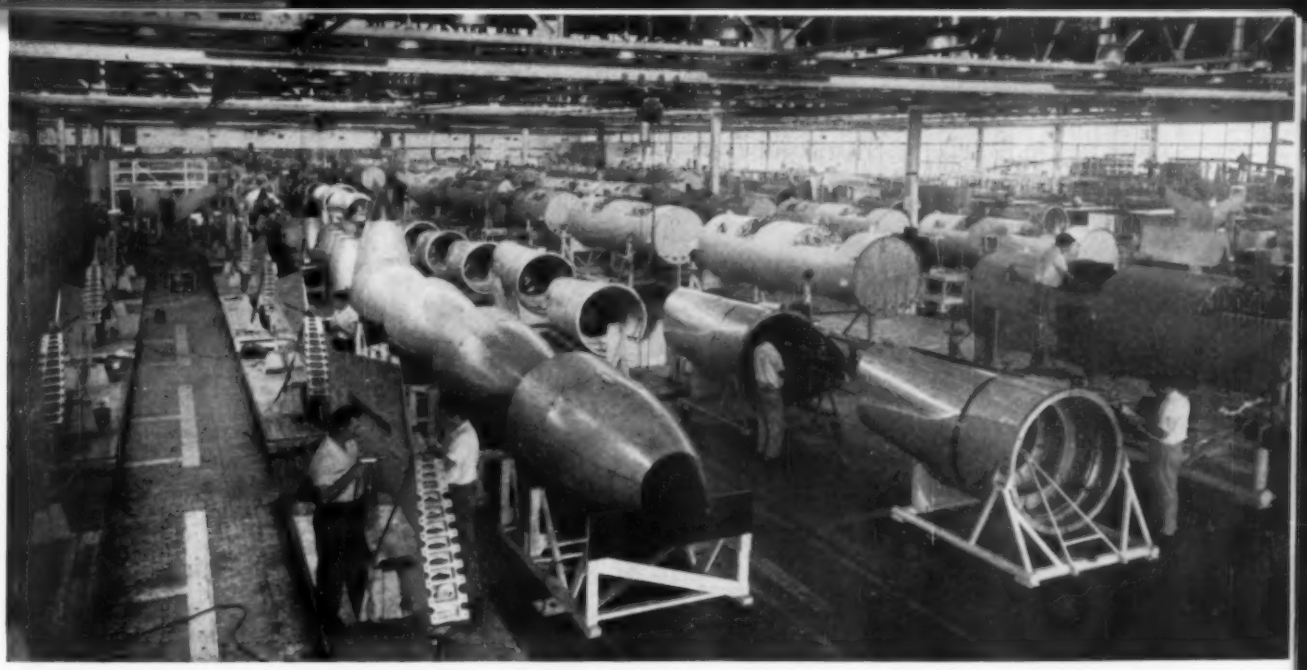


Matador Missile Production

TM-61 Matador missiles, their production boosted by recent Air Force orders, being assembled by Martin workmen. The Matador airframe is manufactured in seven major parts: wing, nose, aft-tail, center section, fin, stabilizer and instrumentation.

Satellite Nears Final Design As Scientists Fight Deadline

Washington—Scientists of Project Vanguard, working against a time deadline for establishing at least one artificial satellite in an orbit around the earth during 1957-58, have determined "ball-park" numbers for the basic parameters of the three-stage vehicle and its instrumented payload.

Current design weight of the satellite itself is 21.5 lb. It will be of metallic construction and have a diameter of at least 20 in. But Project Vanguard is naming no other numbers at this time. Said one spokesman, "We want to be sure the figures are final before we release anything."

Basic design of the three-stage launching vehicle will be the responsibility of the Glenn L. Martin Co. as prime contractor. Subcontracts have been let to General Electric for the first-stage propulsion unit and to Aerojet-General for the second-stage powerplant. Third stage rocket engine, decided upon as a solid-propellant motor, has not yet been awarded.

Martin's Viking high-altitude research rocket will be the basis for the first-stage design. With fins removed, the improved Viking will be controlled in flight by varying the thrust vector direction of the gimbal-mounted first-stage rocket motor.

That motor will be rated at 27,000 lb. thrust, and will burn for 140 seconds, using liquid oxygen as the oxidizer, and a combination of ethyl alcohol, gasoline and silicone oil as the fuel. Turbine-driven pumps will transfer fuel from the tanks to the motor.

Second-stage powerplant will use fuming nitric acid as an oxidizer and unsymmetrical dimethyl-hydrazine as fuel. Propellants will be driven from tanks to motor by a pressurized fuel system, rather than by a turbopump system like that of the first stage, as a weight-saving measure.

Third-stage solid-propellant rocket motor contract has not yet been let, but expected bidders for the job would include Aerojet-General, Allegheny Ballistic Laboratory, Grand Central Rocket Division, Phillips Petroleum's Rocket Fuels Division and the Thiokol Corp.

A disposable nose cone will protect the satellite payload of the third stage rocket from the heat of skin friction generated during the passage through the atmosphere. Expected skin temperatures are approximately 1,000 F.

Flight path will be nearly vertical for about one mile after launching, followed by a gradual turn toward the horizontal. First-stage cutoff will occur at about 30 to 40 miles altitude at a speed of 3,000 to 4,000 mph. The second stage will cut off at about 130 miles altitude at a speed near 11,000 mph. It will then coast under its own guidance into the satellite trajectory.

At 300 miles altitude, the third stage will fire and accelerate the vehicle to the orbital velocity of 18,000 mph.

The start of the International Geophysical Year program in 1957 will be the beginning of the end for Vanguard.

By that date, there must be at least one launching vehicle and instrumented satellite ready to go.

For this reason, Vanguard is choosing only highly developed components and off-the-shelf items wherever it is possible. "We can't afford the time to underwrite research," said one scientist.

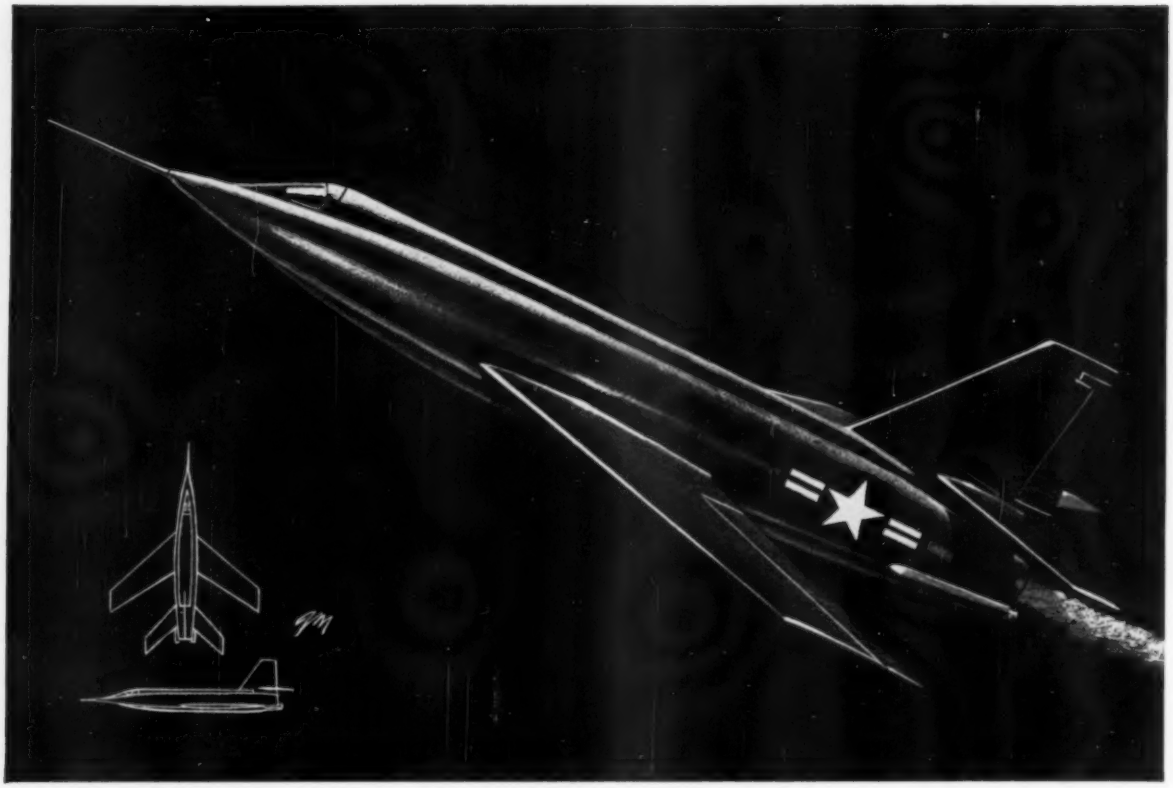
Consequently, every component chosen must be capable of showing optimum performance.

The vehicle will be launched at the Air Force Missile Test Center, Patrick AFB, Fla. The launching itself will have been preceded by "as many test rounds as we can get off," according to a Vanguard engineer.

Six New Navy Planes Get Carrier Suitability Tests

Six of the Navy's newest fighters and attack planes have been given carrier suitability tests aboard the USS Intrepid by the Naval Air Test Center, Patuxent River, Md.

They are the latest model of the McDonnell F3H Demon, the Douglas F4D Skyray, the Grumman F9F-8 Cougar and F11F Tiger, the Chance Vought F7U-3M Cutlass and the North American FJ-4 Fury.



BELL X-2

To explore the Heat Problem at supersonic speeds

This rocket-powered research plane, the Air Force's Bell X-2, is built to fly at high Mach speeds.

As she tries for new speed records, tremendous heat caused by air friction will test her materials at temperatures higher than conventional materials can withstand. So her fuselage skin is made of "K" Monel age-hardenable nickel-copper alloy — wings of chromium-nickel stainless steel — to *stay* strong at high temperatures.

The Bell X-2, like most high speed aircraft, relies on Inco Nickel and Inco Nickel Alloys for the unusual combinations of heat resistance, corrosion resistance, strength and ductility so necessary to safe and satisfactory performance. The Curtiss-Wright throttle-controlled rocket engine which powers the Bell X-2 depends upon Nickel, too, as an alloying element in many of its critical parts.

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University-Industry Plan for Engineers

The University of Arizona is developing a cooperative plan with private and public employers in the central Arizona area in an effort to ease the shortage of engineers. The plan hopes to provide more engineers and help students with limited financial resources get engineering degrees.

Students enrolled in the university-industry program will split their years after the freshman year. Six months will be spent in industry, six months in school. It will take five years, instead of four, to graduate.

John C. Park, engineering dean at the university, says the program was brought to a head by the urgent need of Fort Huachuca, Army electronics proving ground, where dozens of openings for engineers and scientific personnel are going unfilled. Companies which have indicated support of the project include Goodyear Aircraft Corp., Hughes Aircraft Corp., Ai-Research Division of the Garrett Corp. and Motorola Co.

Certificates of Necessity

Scintilla Division of Bendix Aviation Corp., Sidney, N. Y., has been granted a certificate of necessity for an aircraft parts facility, with 40% allowed for rapid amortization, by the Office of Defense Mobilization.

Other recent certificates include:

Solar Aircraft Co., Des Moines, Iowa, military aircraft engine parts, $112,413 certified with 55% allowed.

Bell Aircraft Corp., Wheatfield, N. Y., research and development, $54,444 certified with 60% allowed.

Kearfott Co., Inc., Little Falls, N. J., military aircraft instruments, $64,788 certified with 65% allowed; Black Mountain, N. C., military aircraft instruments, $119,443 certified with 85% allowed; Van Nuys, Calif., precision aircraft instruments, $6,039 certified with 65% allowed.

BuAer Compiles New Airborne Instruments List

Navy's Bureau of Aeronautics has compiled a new list of airborne instruments, procurement of which will be made from Qualified Products Lists under the Armed Services Procurement Regulations.

Manufacturers who are interested in getting their product on the qualified products list for this type of equipment can see the specifications at the office of any Inspector of Naval Material or Bureau of Aeronautics representative.

Copies of the specifications can be obtained from the Technical Records Division, Naval Air Station, Johnsville, Pa.

Army Field Tests New H-34

New Sikorsky H-34 helicopter received an in-the-field workout at Ft. Sill, Okla., to check its combat capabilities.

Top photo shows the H-34 carrying a 105-mm. howitzer, the first time this size artillery, weighing about 2.5 tons, has been delivered with tube in place, ready to fire.

At right, the H-34 lifts a Jeep during the transportability trials. Bottom view shows combat-equipped men of an infantry battalion boarding the helicopter, which can carry 17 troops.

The H-34, which replaces the earlier, smaller Sikorsky H-19 is also built for the U. S. Navy as an anti-submarine aircraft. Airline versions have been ordered by New York Airways and Sabena Belgian Airlines.

FASTER
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The development of guided missiles of every type is becoming one of the most competitive areas in our world today . . . for supremacy in this field can well determine peace for many years. The race is now for greater speed, higher altitude, longer range, more sensitive control.

The strength of Western defense lies to a great extent in the development for the Armed Forces of these new weapons systems suited to the supersonic age. The once deadly cannon, machine gun and rocket are being superseded by complex weapons of great ingenuity.

Canadair has long had a prominent role in Canada's guided missile program, applying the knowledge acquired in years of experience in advanced aircraft systems engineering . . . and Canadair's research, engineering and manufacturing resources are constantly making further important contributions to projects in this field.

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SOLID propellant missile leaves launcher through cloud made by the small rockets which spin-stabilize it.

'Honest John' Replacing Medium Artillery

The Honest John free-flight rocket built by Douglas Aircraft Co. is beginning to replace conventional artillery in the Army's arsenal.

Batteries armed with the new weapon have been deployed in Europe after an intensive training program that includes test firings of live rounds under field conditions at sites north of the White Sands Proving Ground.

Transition from conventional artillery practice to the newer techniques of rocket artillery has been simplified because of two major factors: simplicity of the Honest John weapon system, and the similarity of its fire control system to that of artillery.

Unguided Missile

Chief characteristic of Honest John is that it has no guidance or control after it has left the launcher. All the aiming is done by the elevation and azimuth positions of the launcher itself.

To improve the accuracy, Honest John is spin-stabilized in flight by small rockets mounted in blisters just aft of the warhead. Action of these rockets produces the shroud of white smoke surrounding the noses of the Honest Johns shown in these pictures.

The rocket weighs about three tons, is 21 ft. long and has a 30-in. body diameter.

Powerplant for the Honest John is a solid-propellant rocket charge made by

HONEST JOHN is kept warm by an electric blanket prior to firing. Stabilizing rockets are in blister aft of the white band.

HONEST JOHN is fired at the Grafenwoehr training area in Germany by the U. S. Army's 7th Field Artillery.

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Today over 800 Link jet flight simulators are in active service—evidence of Link leadership in the jet training field. This record is unmatched by any other manufacturer.

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The safety of the crews and passengers, particularly in commercial operations, depends on the absolute mastery of these factors—yet the jet transports themselves are too valuable, too costly to operate for the extensive training required.

Millions of dollars and perhaps many lives would be the cost of crew training—if attempted in jet transports themselves. But actual flight—which makes little allowance for error—is not the only school for our airmen. Thanks to Link's steady technical advances—over more than a quarter century—every problem of jet flight, every maneuver, every emergency can be duplicated economically, safely—on the ground.

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Link alone has delivered flight simulators incorporating DC computer systems; their introduction has meant improved dynamic performance, better built-in checking devices, fewer maintenance problems, and simpler, less costly circuitry. A unique feature of the DC computer system—exclusive to Link—is the *linear interpolator*, which adapts the simulator to new engines via simple manual adjustments.

Among Link's newer flight simulators, which have already saved millions of dollars and thousands of man-hours during their operational history, are these units, for current Air Force and Navy aircraft:

- *Douglas F3D all weather jet fighter*
- *Boeing B-47 six jet bomber*
- *Lockheed F-80 jet fighter*
- *Convair F-102 supersonic all-weather fighter*
- *Northrop F-89D twin jet all-weather interceptor*
- *McDonnell F2H-3 twin jet fighter*
- *Cessna T-37A jet trainer*

Now approaching the delivery stage are these simulators—the newest additions to our nation's air defenses:

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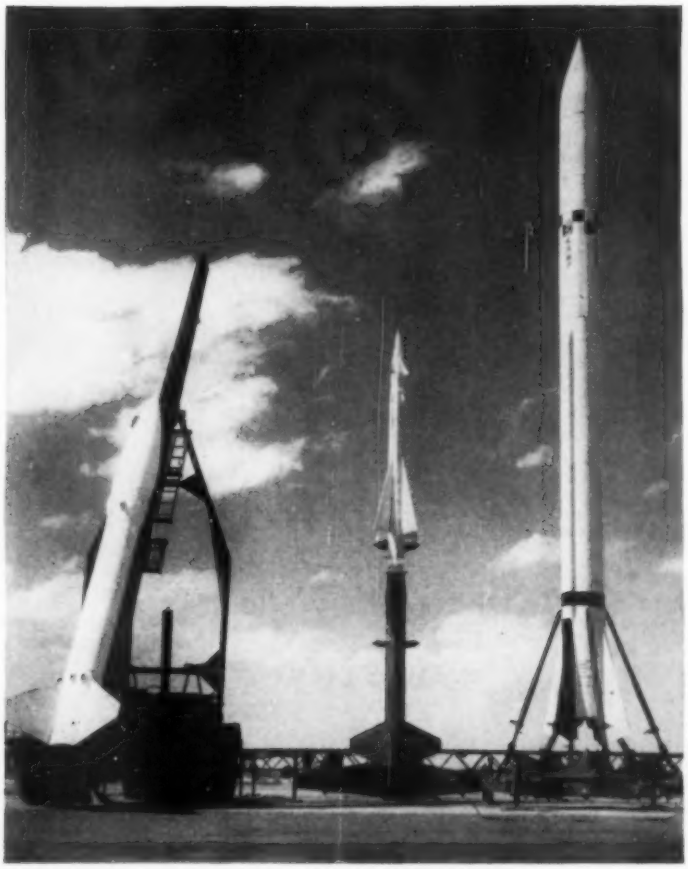

MISSILE Family of the U. S. Army includes Honest John, Nike and Corporal, shown from left to right. Nike is an air defense missile and Corporal is another ground to ground weapon, but with a greater range than Honest John.

Hercules Powder Co. Casing for the charge is manufactured by Alco Products, Inc.

Launcher Details

Honest John's launcher is a self-propelled unit which transports, erects and fires the rocket. Army says the mobility of the weapon is greater than that of conventional artillery.

The rocket is transported with the fins removed and final assembly of the weapon is made in the field at the firing site.

During transport and the time before the battery goes into action, the charge and warhead of the Honest John is kept warm by an electric blanket which shrouds the entire rocket from nozzle to fuse. This heater is built by General Electric.

The launcher is manufactured at the Army's Rock Island Arsenal in Illinois.

Project History

Honest John had one of the shortest development cycle times of any of the current crop of weapons. First studies of large-caliber artillery rockets were made by the Army Ordnance Corps in May 1950. Douglas submitted proposals based on Ordnance studies and specifications, and was asked to go ahead with production of a number of test and development rounds.

First firings were made at White Sands during August 1951, only a little more than one year after paper studies of the weapon began. Large-scale production of the Honest John began in January 1953 at Douglas, and since then, an extensive effort by that company and associated subcontractors on the program has kept the Honest John pipeline full.

Test firings under field conditions have been made by the 7th Field Artillery (Rocket) Battalion at the Grafenwoehr training area in Germany. Other test rounds have been fired in Japan on the lower slopes of Mt. Fuji, using concrete warheads in place of explosives. Range of the rocket during the latter tests was about six miles.

Next step in the Army program will be the Sergeant, a larger solid-propellant rocket with performance better than the Honest John and comparable to that of the guided Corporal liquid-propellant rocket.

Commerce Expanding Weather Broadcasts

Washington—An expansion of Flying Weather Broadcast Services which promises to be a significant development in air navigation safety services is to be undertaken by the Department of Commerce.

The service will provide a continuous broadcast of aviation weather and notices to airmen. It will be patterned after the experimental broadcast originated more than a year ago by the Weather Bureau and the Civil Aeronautics Administration on the low frequency air navigational radio range at Arcola, Va., near Washington.

Expansion will add 21 continuous broadcasts at most of the principal cities of the country. The ultimate plan involves a network of 86 stations using low and medium frequency ranges.

Flying weather broadcasts are made from especially designed tape recorders and repeater equipment. New weather reports are added to the broadcast at least once an hour. Information covers an area of approximately 250 miles from the station.

AMC Changes Assignments In Three Key Posts

Dayton, Ohio—Air Materiel Command has made the following personnel changes:

• **Col. John M. Bartella,** former chief of staff of Southern Air Materiel Area (Europe), has become Deputy Director of Transportation and Services and chief of the Transportation Division. This directorate handles a billion-dollar-a-year business in transportation and packaging.

• **Col. Marion G. Ferguson Jr.,** who held the job Col. Bartella is filling, has been reassigned as chief of the Cataloging and Standardization Division, which catalogs and standardizes program involving 1,200,000 items, and distributes technical and procurement data.

• **Col. Asher B. Robbins Jr.,** former chief of the Cataloging and Standardization Division, has been reassigned as chief of the Plans and Operations Office in the Directorate of Supply.

GE Jamming Equipment In Quantity Production

Airborne countermeasures equipment, designed to jam enemy ground radars, is in quantity production for the Air Force at General Electric's Light Military Electronic Equipment Department. The new ECM equipment has, according to General Electric, "considerably increased reliability and flexibility over earlier countermeasures units."

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Young in years, old in experience, Giannini is confidently entering its second decade of operation with the assurance gained by its 10 years of production to the aircraft and missile industry.

Engineering positions are open at several Giannini locations for career-minded young men–write for details.

1945

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GYRO INSTRUMENTS

DIGITAL DATA RECORDING SYSTEMS

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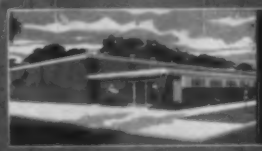

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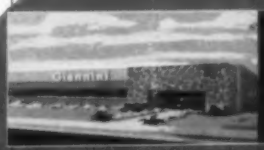

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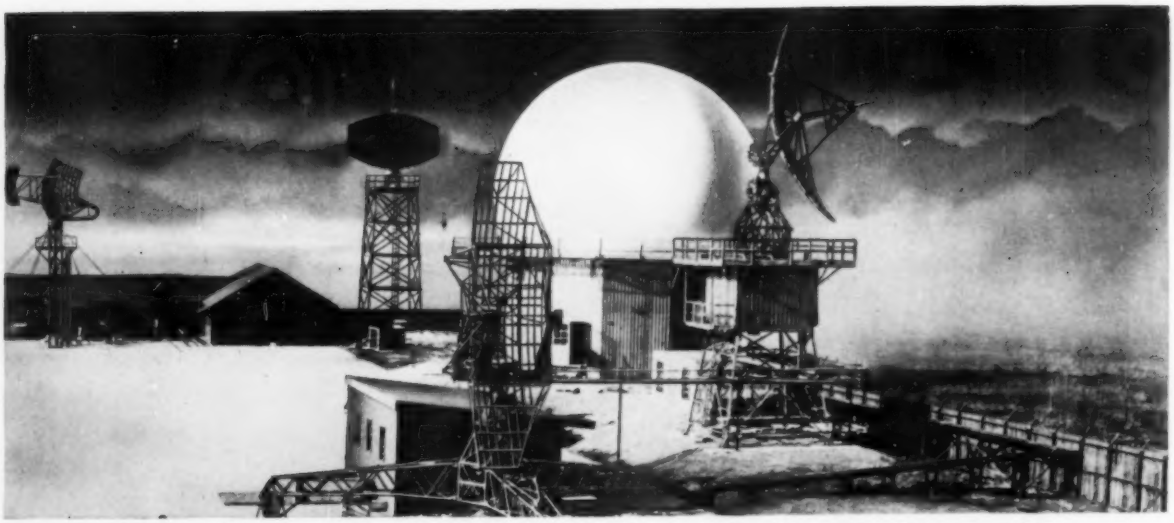
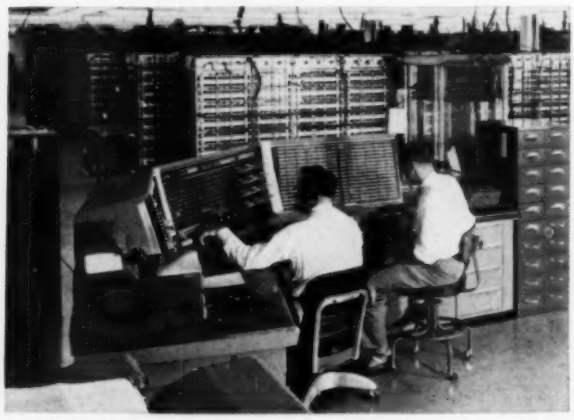


AIR DEFENSE RADARS, above, provide one source of data on location of all aircraft. The data is automatically processed by . . .



SAGE DIGITAL COMPUTER that calculates time and location of earliest possible interception and flight path the fighters must fly.

GROUND CONTROLLERS get a pictorial display of the battle area showing hostile and friendly aircraft, missile and anti-aircraft sites.

SAGE Provides New Defense Concept

By Philip J. Klass

Lexington, Mass.—The air defense SAGE (Semi-Automatic Ground Environment) system, one of the boldest military projects ever to be undertaken in peacetime, is beginning to move from concept into operating hardware. In terms of scope and complexity, the multibillion-dollar SAGE ranks with the World War II Manhattan Project and the present intercontinental ballistic missile program.

Intended to at least partially counter the vastly increased offensive power of airborne nuclear weapons, SAGE basically is a complex electronic data processing system—the most complex, in fact, ever attempted.

It consists of an interconnected network of huge digital computers, each fed by a group of air defense radars and from other sources. The computers automatically process this data, calculate battle instructions and display the air battle situation pictorially for human controllers. Eventually, the system will have the capability of automatically guiding interceptors and missiles, such as the Bomarc, to intercept hostile aircraft.

Prototype Under Test

A production prototype known as the "little SAGE system" is being readied for final evaluation tests at the Massachusetts Institute of Technology's Lincoln Laboratory. The laboratory is located at Hanscom AFB a few miles northeast of Boston and only a stone's throw from historic spots where American independence was first defended.

Many Firms Participating

When the system is fully implemented, there reportedly will be 32 sub-sector "Direction Centers," each housing a dual computer installation. The second computer, serving as a standby, will be in continuous operation, ready to take over on a moment's notice.

Some idea of the scope of the SAGE program can be gained from the number of major companies and organizations participating in the project. Major contractors include:

• **International Business Machines Corp.** designed and is manufacturing the AN/FSQ-7 digital computers which

form the heart of the SAGE system.

• **Burroughs Corp.** is making similar, but smaller, computers "for outlying stations."

• **Western Electric** is responsible for installing and servicing the SAGE system.

• **American Telephone & Telegraph Co.** is providing the interconnecting land lines and radio communications circuits.

• **Bendix Radio and Hazeltine** are major sub-contractors to IBM on the radar scope display consoles and controls.

• **Air Force Cambridge Research Center** and the Rand Corp. provide technical support for the program.

Man-Machine Partnership

The SAGE system is designed to make use of the best aptitudes of both man and machine. For example, a machine is extremely fast on repetitive and routine operations and maintains a constant level of alertness without fatigue. Even the "brightest" digital computer, however, cannot improvise or invent a solution to a new problem which its designers never envisioned.

This, Lincoln Laboratory's Robert Wieser pointed out, is where the human brain excells.

The obvious solution is to combine man and machine, but this is not without certain problems, Wieser admitted. For example, communication between a human operator and a digital computer is one such problem.

Before and after SAGE

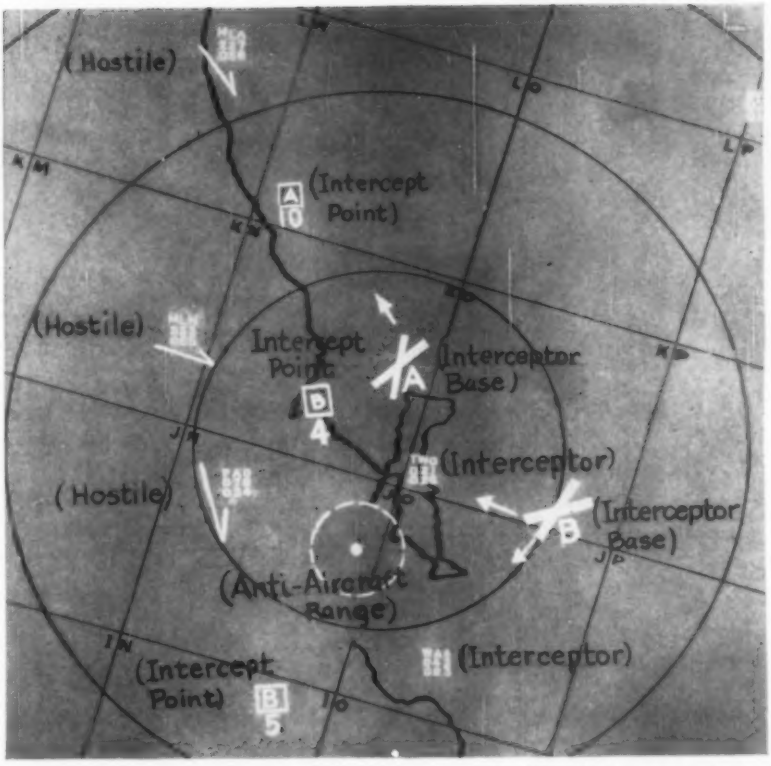
To fully appreciate the significance of SAGE, it is necessary to examine the techniques which it replaces. In the past, for instance, the basic building block of air defense was a single radar rather than an interconnected network of radars.

Information on the position of targets appearing on the radar scope had to be transmitted orally by interphone to operators who plotted the track of aircraft, while other operators compared these tracks against flight plans of friendly aircraft.

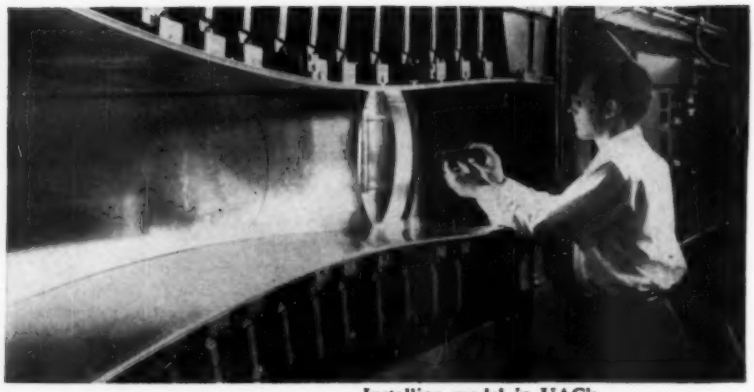
If the aircraft were hostile, human operators had to quickly estimate their speed and then calculate what course our own interceptors should fly to bring them within range of where the hostiles would be when the interceptors got there. Such instructions had to be transmitted by voice radio to interceptor pilots.

If the battle action moved into the range of another radar, information on the battle situation had to be quickly transferred verbally to an adjacent control center. With the prospect that air battles of any future war will be waged at supersonic speeds, such "pony express" techniques clearly are not adequate.

When the SAGE system is fully implemented at some undisclosed future



INSTANTANEOUS DISPLAY of SAGE (above) contrasts sharply with the present plotting-board (below), which involves verbal transmission of data between human operators.



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date (perhaps three to five years), it will operate, according to information released by the Air Force, as follows: When an aircraft enters a radar coverage area, data on target position will be automatically transmitted to the nearest sub-sector "direction center." The data may come from a large ground-based radar, a small "gap filler", radar, an off-shore Texas Tower, picket ship, early warning aircraft or ground observers.

The direction center's computer will instantly search through its magnetic memory for previously filed flight plans of friendly aircraft, seeking one which corresponds to that of the unknown. It then displays the probable position and altitude of such aircraft on the scope of the identification officer.

From this, and the use of radar identification (IFF) beacons similar to those used in World War II, the identification officer declares the unknown to be friendly or hostile. By actuating a button on his console, the scopes throughout the direction center will be caused to so identify the aircraft.

If Hostile

Meanwhile, the computer has assigned an identifying track number to the unknown, computed its speed and heading. This information is displayed pictorially on direction center scopes by means of a vector line extending from the target blip. Direction of the line shows target heading, while its length indicates target speed.

This same information, plus the hostile's altitude (obtained from a height finder radar) is also displayed symbolically by means of a Convair Charactron cathode ray tube (AW–Nov. 15, 1954, p. 77) which functions as the console scope.

Battle Situation Shown

In addition to showing target information, the computer electronically "paints" a map of the surrounding area on the scope, showing sub-sector boundaries, location of interceptor bases, anti-aircraft installations and missile sites. Also shown is the effective range of the anti-aircraft and missile batteries.

By the time the identification officer has established that the aircraft is hostile, the SAGE computer will have

Russian SAGE?

Asked whether the Russians have developed an air defense system similar to SAGE, Lincoln Laboratory's Dr. George Valley said that "if the Reds choose to build a SAGE system, they probably can match it as closely as they approach us in other forms of technology."

Conception Of SAGE

The present SAGE system is a direct outgrowth of an imaginative concept for making a major advance in the air defense art that was conceived before the first Russian atomic explosion. Credit for the concept generally is given to now retired USAF Maj. Gen. Gordon P. Saville.

In the spring of 1949, the USAF called together top officials of some 50 major aircraft, engine and avionic firms to consider the pressing problem of continental air defense. The present SAGE system, as well as completely automatic radar-directed fire control systems for interceptors, were part of the USAF concept.

A few months later, the Soviet Union exploded its first atomic bomb, at least several years in advance of then-current predictions. Shortly afterwards, a group known as the Air Defense Systems Engineering Committee (ADSEC) was formed to study the effectiveness of the U. S. defense against air attack. The ADSEC recommendations were in turn scrutinized by another group, called "Project Charles," headed by Dr. F. W. Loomis.

This, in turn, led the three military services, in 1951, to jointly request MIT to organize Lincoln Laboratory, drawing on MIT's own scientists to form the nucleus of the new facility. From this small beginning, Lincoln has grown to the point where it now employs 2,000 persons, of which 700 are engineers and scientists. Dr. Marshall G. Holloway is director of the laboratory; Dr. George E. Valley, Jr., is associate director.

In addition to SAGE, Lincoln Laboratory has other air defense projects, including the development of ionospheric and tropospheric scatter systems for beyond-the-horizon transmission of UHF radio signals. This technique is used to link air defense radars in the far north with the continental air defenses.

calculated how long it will take for fighters scrambled from each of several different bases within the sub-sector to intercept the hostiles, as well as the estimated geographic points where interception could take place. This information is displayed on the scope of the Weapons Assigner.

For example, the point where interceptors from air base "A" can be expected to intercept the hostiles is shown on the scope by a letter "A," enclosed in a small square. Underneath the square will be figures which show the estimated time to interception in minutes. Vector lines radiating from each interceptor base indicate the initial heading which its fighters must fly to reach the target.

Lincoln Laboratory officials say that all this information will normally be presented in less than a minute after the enemy aircraft is first detected.

Human Judgment Needed

At this point, human judgment enters the picture. For example, if the interception cannot take place until the enemy is within range of anti-aircraft or the missile site, then the Weapons Assigner may decide not to launch any interceptors. Or, if there are several hostile aircraft coming in from different directions, he must size up the situation and decide what components of his defense arsenal to throw at each.

If the Weapons Assigner decides to scramble interceptors from base "A," he delegates this target and mission to the Intercept Director for base "A," who sits at his side. If there are several targets and the Weapons Assigner decides to scramble from several bases, additional Intercept Directors would be brought into the operation. In this way, a mass raid can be broken down into manageable missions.

Automatic Guidance

The scopes in the consoles of the Intercept Directors display a picture similar to that of the Weapons Assigner. If desired, portions of the display can be expanded or off-set on the scope to concentrate on a particular segment of the battle area.

In the initial phase of SAGE implementation, guidance instructions to the interceptor pilots will be relayed by the Intercept Director via voice radio. At a future date, however, it is planned to add an automatic "data link." This will make it possible for

SAGE computer's magnetic core storage.

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Now—and all through 1956—courses on J79 installation and operation, as well as J79 accessory systems, will be conducted, in addition to those on the J47 and J73. Besides 250 G-E field service engineers, many other personnel will attend from the Armed Services, airframe companies, and the NACA.

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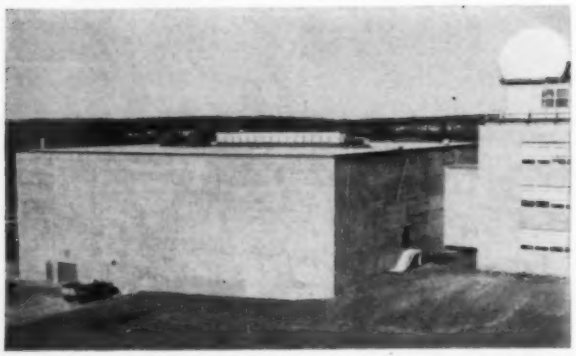

MIT'S LINCOLN LABORATORY (at left) developed SAGE system. The prototype system is undergoing test in blockhouse at right.

the SAGE computer to automatically guide the interceptor to within range of its own airborne radar. From this point, the interceptor's automatic fire control system takes over and maneuvers it into attack position, automatically firing its aerial rockets or guided missiles at the proper instant. (AW Oct. 31, p. 36.)

When data link becomes operational, the role of the Intercept Director will be largely one of monitoring the situation, Lincoln Laboratory spokesmen say.

Answer To Saturation Raids

The real pay-off from the SAGE system comes during a multi-pronged attack which is intended to saturate the air defense, according to Dr. George Valley, Jr., associate director of the Lincoln Laboratory. Such a multi-pronged raid can easily confuse and rattle human operators in the old style air defense set-up, whereas SAGE computers should be able to remain calm and collected.

If the hostiles should take evasive action, the SAGE computer automatically computes a new intercept path and modifies its command guidance to the interceptor. If a hostile flight splits up into individual aircraft, then the human judgment of the Intercept Director must come into play in the reassignment of the intercept missions.

For obvious reasons, Lincoln Laboratory officials give no figure on the number of friendly and hostile aircraft which a SAGE computer can handle before it reaches the limit of its capacity. It is conceivable, however, that if one sub-sector computer became saturated, it could call upon the adjoining sub-sector computer for assistance or else make use of its standby.

If one direction center is knocked out of action, the system is designed to permit adjacent centers to take over its sub-sector operations.

Computer Details

Information released on the SAGE computers show that they are parallel, binary-coded machines designed to op-

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SAGE for Traffic Control?

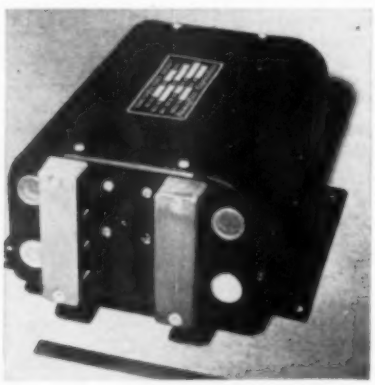
Dr. George Valley, of Lincoln Laboratory, said the SAGE system has the capability of handling civil air traffic control in addition to its air defense duties. In reply to a question, he said: "It can be done, but I am not qualified to say whether it should be done."

crate in "real time." That is, the machine computes instantaneously and continuously from variable input data as it is received. The computer is programmed from punched cards, but routines can be modified during operation by means of controls on the consoles of the Weapons Assigner, Intercept Director and others. The program is stored in magnetic memory drums.

For intermediate rapid-access (buffer) storage, the computer employs two large banks of magnetic core matrices, each bank capable of storing 4,096 words, each 33 bits long. Access time to this buffer storage reportedly is six microseconds.

The present SAGE computer design was developed following tests at Massachusetts Institute of Technology on the Whirlwind I computer. To prove out SAGE fundamentals, MIT set up the Whirlwind computer to be fed by data from several radars in the Boston area in what was called the "Cape Cod System."

Some observers speculate that it will



Lightweight Converter

Lightweight a.c. to d.c. converter, using high-temperature silicon rectifiers, delivers 100 amp. at 24 v. d.c., but weighs only 8 to 10 lb., depending upon whether air blast or fan cooling is desired. The converter, which operates from 200-v., 380-1,000 cps., three-phase input, can deliver 150% load continuously at altitudes up to 65,000 ft., with maximum ripple of 5%, the manufacturer reports. Units rated at 20 and 200 amp. also are available. Maker is the Permoflux Corp., 4101 San Fernando Road, Glendale, Calif.

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Currently, Temco assembly lines are working on components for the **F-100, F-101, B-52, B-47, F-84, C-123, F7U, F3H** and others.

Temco designers are in the middle of work on additional components for the Lockheed Electra and several other aircraft, plus some design projects of their own.

Interesting.

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be three to five years before the complete SAGE system is implemented in its present form. Lincoln Laboratory officials, however, indicate that, with the prospect of long-range bombardment missiles, the problem of air defense is a never ending one. For this reason, SAGE must continue to grow in capability and sophistication to meet a threat which becomes more difficult to solve as enemy technology advances.

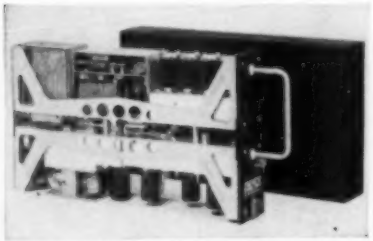
FILTER CENTER

▶ **Hughes Eyes Traffic Control**—Hughes Aircraft Co. is investigating current problems in civil air traffic control as a possible outlet for some of its military systems engineering capability.

▶ **Reliability Data Swap**—Electronic equipment and component manufacturers will shortly be surveyed to determine if they are interested in setting up an industry-wide program to swap the results of component qualification tests. The project, sponsored by Radio-Electronic-Television Manufacturers Assn., is expected to show that much costly component testing is needlessly duplicated by large numbers of firms. Non-RETMA members who would like to participate in survey may write A. Warscher, Eclipse-Pioneer Div., Bendix Aviation Corp., Teterboro, N. J.

▶ **Coals To Newcastle**—Hughes Aircraft, itself a major producer of digital computers for avionics and military applications, has rented its third IBM 650 magnetic drum data processing machine from International Business Machines Corp. New machine will be used for engineering problems; the previous two were used for general accounting.

▶ **Welcome Mat Out in Arizona**—Arizona's recent action in exempting manufactured goods sold to the federal government from its state 2% sales



Half-Size Receiver

New miniaturized glide slope receiver comes in a short ½-ATR size case and weighs only 7 lb., half the size and weight of its predecessor. The new 51V-3 receiver is one of Collins Radio Co.'s new line of miniaturized avionics equipment for airline and business aircraft.

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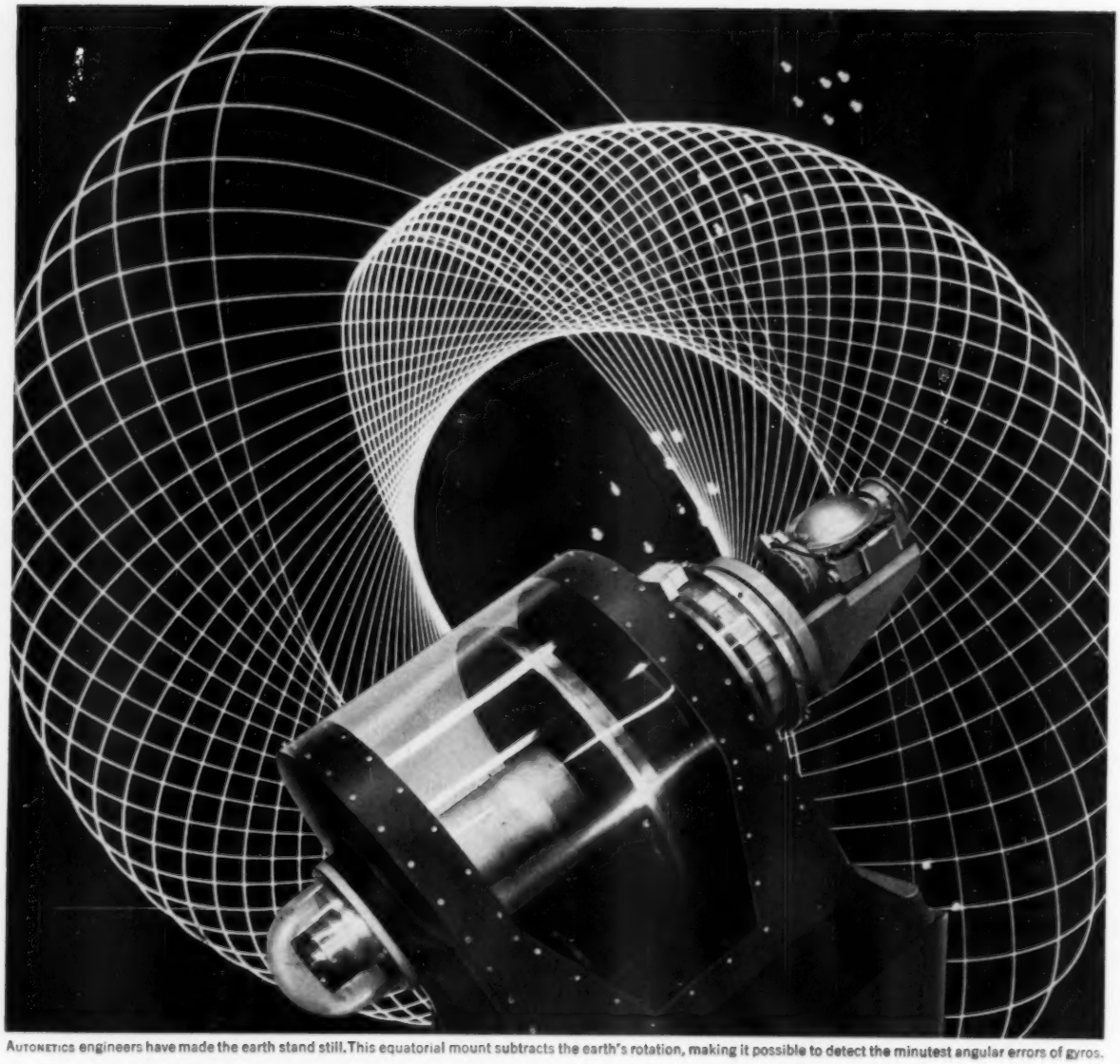

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We'll be glad to tell you what we can—within security restrictions—of the work being done here. If you have a legitimate professional interest in the subject, write AUTONETICS, Dept. W-1, 12214 Lakewood Blvd., Downey, Calif.

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tax is intended to attract more manufacturers. The move is credited with being a factor in Sperry Rand's recent decision to build an avionics facility near Phoenix (AW Jan. 9, p. 34). Other avoinics firms with facilities in Arizona include Collins Radio, Hughes Aircraft, Melpar and Motorola.

▶ **What's New in Components**—If components presently available do not meet the operating or environmental requirements of new equipment now under development, you can find out if suitable components are under development. The Armed Services Technical Information Agency (ASTIA) publishes semi-annually a report called "Electronic Components Development Register." The publication is classified "confidential" but is available on a "need to know" basis to government contractors. Write ASTIA, Knott Bldg., Dayton 2, Ohio, and ask for AD-63205.

▶ **Ask It a Question**—A high-speed computer memory has operated for six months "memorizing" the equivalent of 100 billion letters without making a single mistake, according to International Telemeter Corp., which developed the device. The storage element employs 163,840 magnetic cores, is able to read out stored information in less than five microseconds. Device is used in the Remington Rand Johnniac computer.

Miniature Recorder

Miniature tape recorder, ruggedized for missile use, measures only 4 in. in dia. x 5 in. long and weighs 5 lb., including battery and armor for ground-impact protection. The Model MR-1 recorder provides eight channels and can handle both d.c. and a.c. signals. Recording head sensitivity reportedly is sufficient to eliminate pre-amplifiers and overall accuracy is quoted at 5% full scale. With tape speed of 4 in./sec., the unit has running time of about one minute. North American Instruments, Inc., 2420 North Lake Ave., Altadena, Calif.

(Advertisement)

Valve Talk

for WM. R. WHITTAKER CO., Ltd.

by Marvin Miles,
Senior Member, Aviation Writers Assn.

Project Vanguard — the creation of an artificial space satellite — has been widely publicized in recent months, but the relatively unknown project that intrigues me even more is that of the X-15.

This is the piloted rocket plane ordered from North American Aviation, a plane now being designed for an altitude goal of 100 miles or 528,000 feet!

The space satellite will be hurled into an orbit 200 to 300 miles above the earth, at maximum only about 50 miles—or one-fifth—higher than the present altitude record held by the two-stage V-2 Wac rocket. The X-15, if it is successful, will in one giant jump take man more than five times higher than the 90,000 feet he has reached to date.

There are, of course, complex problems involved in the man-made moon experiment, even though the first satellite itself will be no larger than a basketball. But North American faces as many problems in creation of the X-15, problems compounded by the human factor which makes this project fascinating in scope and, to me, more dramatic.

In my mind, man at 100 miles is far more incredible than a globe-girdling sphere at 300 miles.

The X-15 must not only be able to attain the stupendous altitude set for it. The ship must also provide for the safety of the pilot aloft, safety against meteorites and cosmic rays, against extreme heat and cold. It must contain safeguards against explosive decompression and facilities for emergency escape at altitudes never before explored by man, possibly some sort of jettisonable capsule.

Its design and operation must take into consideration a variety of physical effects upon its pilot, the results of acceleration, weightlessness and speed, for instance.

And whereas the satellite will burn itself up like a meteorite as it plunges back into the atmosphere once its job is done, the X-15 must be capable of making a re-entry into the atmosphere that will bring the pilot back to earth safely. Guesses in this area have included the use of wings retractable for climb, extended for descent; vertical landing capabilities and the use of a huge parachute once the ship has dropped into heavier atmosphere. My guess is that it will make a normal landing the same as any other high performance research plane.

Will the X-15 have nuclear power? It's very unlikely there's any answer yet, for North American has had the project for only a few months, but I feel nuclear power of some sort is a distinct possibility.

In considering the two projects it becomes evident that they will both materialize at about the same time. The first satellite is planned for the forthcoming international Geophysical Year between July, 1957, and December, 1958, while the best information on the X-15 is that it will be ready for flight late in 1957.

Unlike the satellite, however, the X-15 is a military project, sponsored by the Air Force, the Navy and the National Advisory Committee for Aeronautics. The Defense Department's only part in the satellite program is to handle contracts, provide facilities and probably conduct the launching. Otherwise the project is for purely scientific purposes, with all nations to share in the data gathered.

This will include more comprehensive information on air densities at different heights, amplification of knowledge on the earth's gravitational field, data on the reflectivity of the earth's surface, the intensity of the sun's ultra-violet radiation and its correlation to weather changes, the presence and volume of micrometeorites, etc.

While it will not remain in the fringe of space as long as the satellite – which has been estimated anywhere from a few days to several months – the X-15 should give invaluable information on the one factor the tiny slave moon cannot provide. The effects on man. Between the two, these projects should go a long way toward developing approach techniques for true space travel. Still, the one that catches my imagination is the X-15.

Through the historic fact of flight itself, through the development of conventionally-powered combat and transport aircraft to the jet and the rocket and conquest of the once-dreaded sonic "wall," the march of aviation has shouldered its way, but, with man aboard, never very high as distance goes.

Now begins the reach for the stars.

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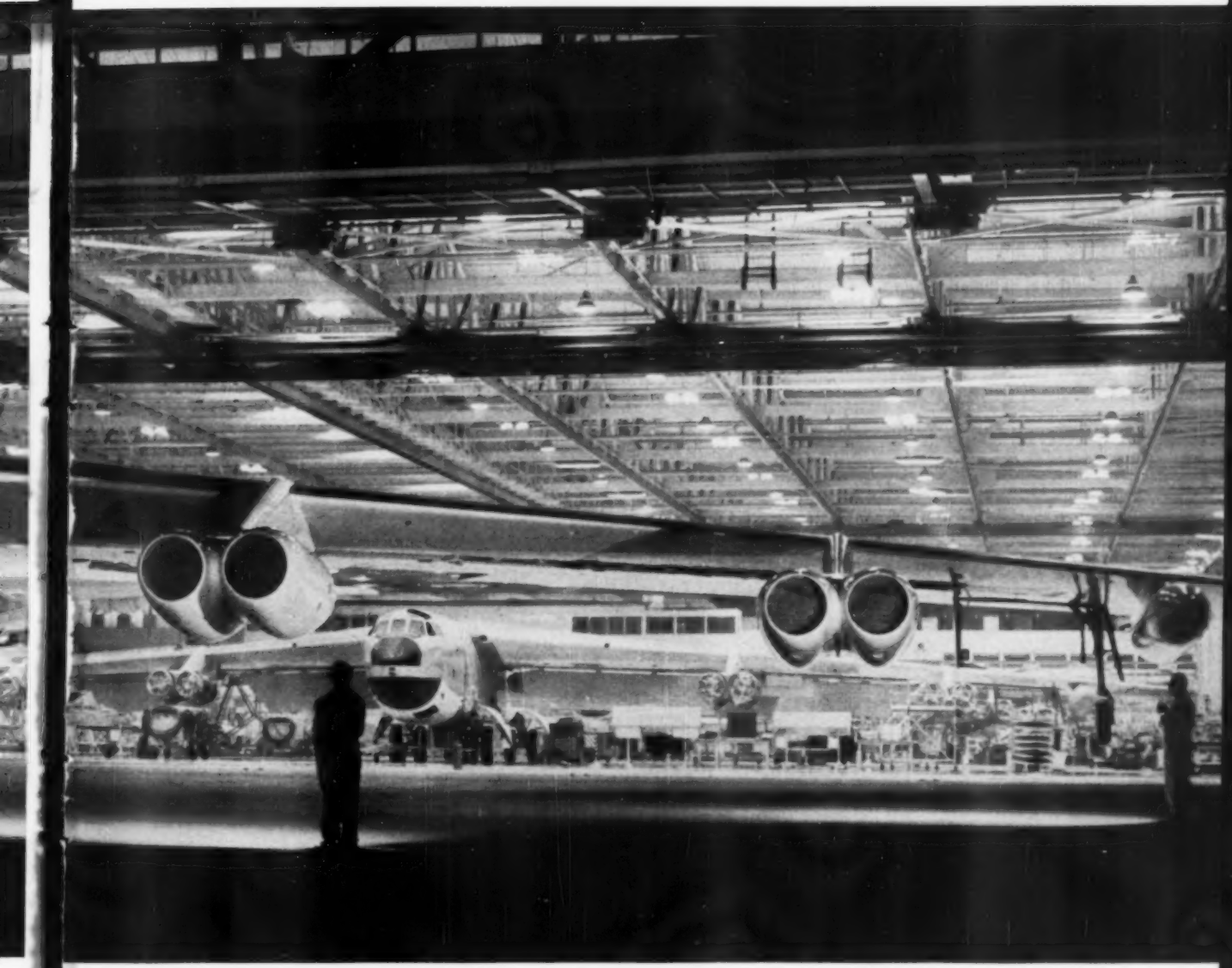

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61

FUSION WELDING is used to join the precision-formed, alloy-steel components which comprise the main landing gear bulkhead of Boeing's eight-jet B-52 bomber.

'Thermal Barrier' Puts Emphasis On Precision Forming Techniques

By George L. Christian

Milwaukee—Precision hot forming and welding techniques for fashioning and fabricating hard metals are becoming increasingly important as supersonic aircraft penetrate deeper into the "thermal barrier," requiring greater use of heat-resistant high-strength metals.

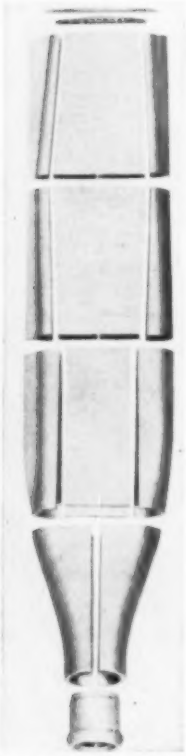
A. O. Smith's Aviation Division is now studying the application of its precision hot working and welding techniques to steels in the 220,000-300,000 psi. ultimate tensile strength range and to new titanium alloys. The Air Force is also interested in applying A. O. Smith's know-how with these difficult-to-handle materials to future needs.

Air Research and Development Command has placed contracts with the firm, calling for:

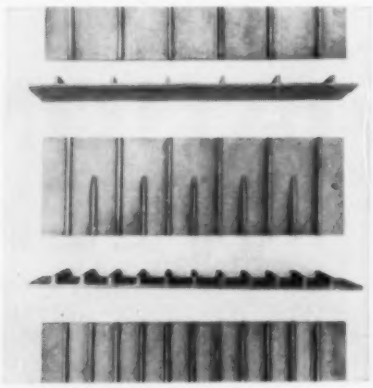
- **A report comparing** the company's hard metal forming and welding processes with techniques of forging and machining soft metal (aluminum) components and subsequent mechanical attachment.
- **Technical processing data** on application of A. O. Smith's contour-rolling techniques to the manufacture of integrally stiffened wing skin made of high-strength steel or titanium. This data is to go into a revised edition of the Aircraft Designers Manual published by the Air Force.
- **Experimental propeller blades** of titanium for transonic speeds. An A. O. Smith spokesman said the blades—about six ft. long and 18 in. wide are as strong as steel and weigh one-third as much. The blades are contour-rolled to airfoil shape. The shank is a hollow two-piece unit and the blade itself is solid.

These units are being made for Wright Air Development Center.

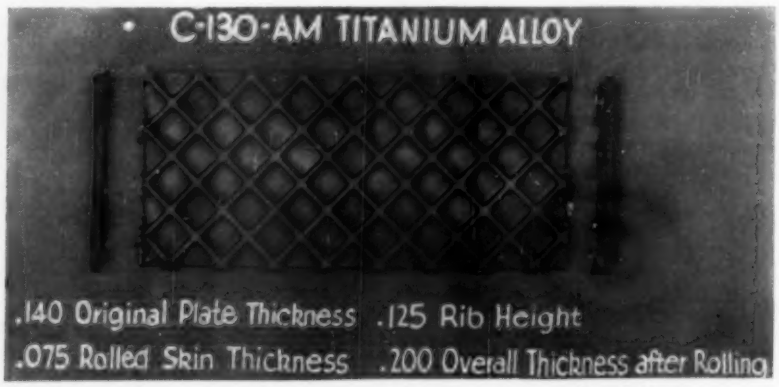
For the National Advisory Committee for Aeronautics, the company is producing isogonigrally stiffened (waffle pattern) sheet out of 7075 aluminum alloy that is ¼ in. thick before rolling. The same die used for the aluminum also has been used to form C-130-AM titanium and AMS6428 alloy steel on a contour draw mill. Sheet measuring up to 27x65 in. has been processed to date.



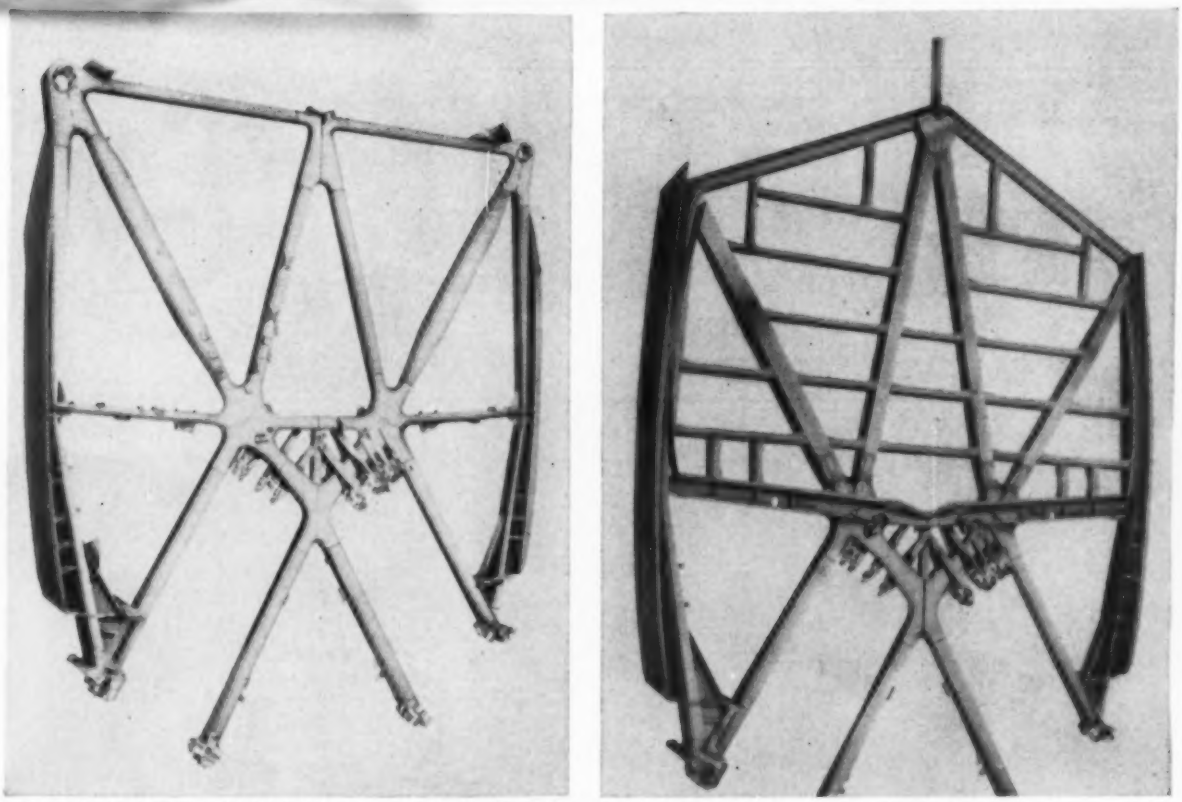
B-36 PROPELLER requires 17 weldings.



INTEGRALLY-STIFFENED steel sheets.



TITANIUM ALLOY type C-130-AM formed into isogonigrally stiffened sheets.



FRONT (left) and **REAR** (right) landing-gear bulkheads. Black lines show weld points joining various bulkhead components.

NACA is currently testing samples.

A. O. Smith is interested in the manufacture of whole missile structures, except the guidance system. The company has undertaken a research project for one manufacturer and has a number of proposals out to other missile companies.

Jet Components

The firm also is adapting its process capabilities to modern jet engine components.

It has made sample spacer rings of titanium and company engineers believe they can contour-roll compressor blades at least six in. long. Smaller blades could be forged.

They are also investigating the manufacture of rotating rings, compressor housings and rotor discs.

The company has set up a number of basic guides for hard-metal fabrication:

- **Use hollow construction** wherever possible.
- **Distribute the metal** precisely where required. Obtain optimum metal distribution with a uniform stress pattern. Make the metal thick only where it has to be thick—in high-load areas—and thin in lower-load areas.
- **Join by high-strength flash** or fusion welds.
- **Keep machining operations** and mechanical attachments to a minimum.

The result, A. O. Smith says, will be a product that is practical and economical to manufacture and one which carries no weight or space penalty. In many cases, the company says, it makes steel parts that cost appreciably less than comparable aluminum units.

They are also lighter.

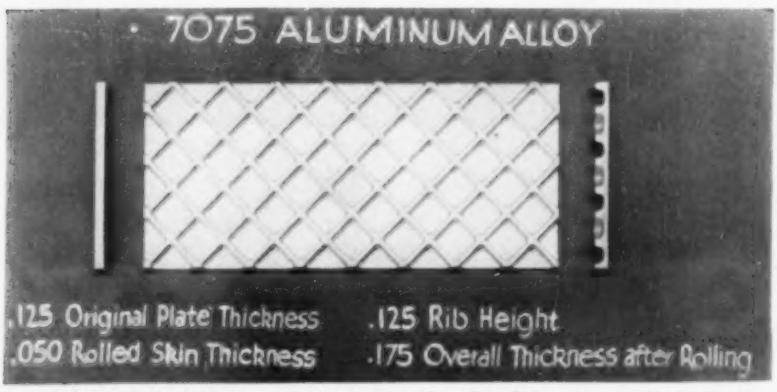
A. O. Smith officials say the backbone of their company's manufacturing cycle is its method of joining precision forged and formed parts by flash welding.

This is a repetitive process fully mechanized and easily expandable. The parent metal is joined, yielding high strength aircraft quality welds, with a minimum of wasted material. Company-developed flash welders can handle almost any type of welding job easily and quickly, permitting efficient production, whether for a few pilot models or mass production.

The company says its technique permits setting up a number of different parts for consecutive welding, thereby providing optimum machining utilization and reduced costs.

A. O. Smith engineers enumerate the main advantages of alloy steel contour weldments over machined aluminum alloy forgings as follows:

- **Raw materials:** reduction in weight and cost. Weldments use less material (fewer chips than machined parts) and less expensive metals (alloy steel costs approximately one-eighth as much as aluminum alloy, the company says).
- **Finished part:** reduction in weight.
- **Skilled personnel:** contour weldment



ALUMINUM 7075 ALLOY formed into isogonigrally-stiffened sheet in same die as titanium.

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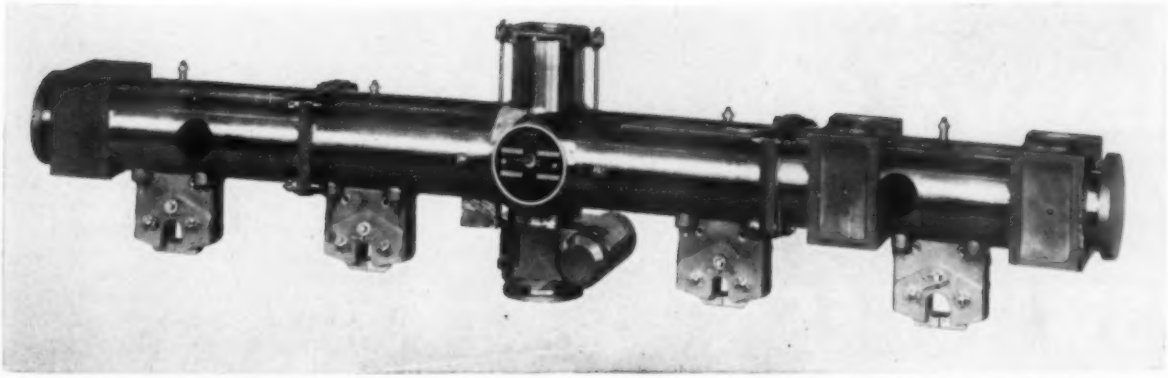


STAINLESS STEEL BOMB EJECTOR made by A. O. Smith's Pacific Coast division under a subcontract from Douglas Aircraft Co.

manufacturing requires only one-third as much skilled man-power as producing aluminum alloy forgings.

• **Repairability:** damaged weldments can usually be repaired by welding, even after heat treatment. This cannot be done with aluminum alloy components, A. O. Smith says.

• **Rejection of defective components:** because weldments are built up of several parts, any defective component can be easily "scrapped out" as discovered, before costly semi-finished or finished stage is reached.

• **Conversion from steel to titanium:** as titanium becomes more extensively used in aircraft, conversion for handling the new metal will be simple because only minor changes in tooling, equipment and manufacturing techniques are required, according to A. O. Smith engineers.

• **Facilities required for weldments:** for manufacturing a given B-52 airframe component at the rate of four sets a month, A. O. Smith estimated that the cost of a weldment facility would be only 40% that of a machining facility. At a rate of 16 sets a month, the percentage drops to 25%.

• **Tooling:** weldments require relatively few and simple machine tools, and a minimum number of special pieces of equipment. Welding equipment is readily available and weldment production expansion is handled easily and inexpensively.

Welding does have disadvantages, however, the company's engineers admit. Tooling process development is more difficult, more costly, and requires a considerably greater degree of technical and mechanical skill than for machining.

Long on Experience

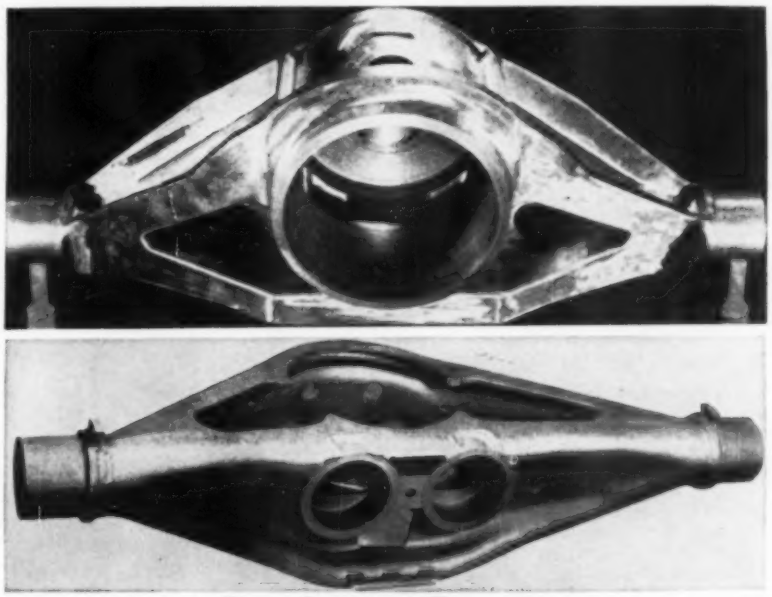
A. O. Smith has been in the welding business for 35 years. Today, in a typical work week, it uses over 1 million lb. of steel an hour, and an average of 10 tons of electrodes each day.

A few years ago, when the company went into mass production of B-36 propeller blades, established propeller manufacturers questioned its plan to weld together 17 prop blade parts which had been formed by precision forging and/or contour rolling. Transverse welding was particularly questioned. But A. O. Smith developed a way to flash-weld every joint except one near the blade tip, which was fusion-welded. The A. O. Smith blades held together, were as light as standard blades and were less expensive, the company says. Furthermore, the component construction technique, as used on the B-36 propeller, permitted high producibility and ready adaptability to design changes.

The contour-rolling operation, as used by A. O. Smith, combines the essentials of rolling and forging into one, according to F. A. Gruetjen, director of aeronautical development. Flat bed dies afford positive control which, according to Gruetjen, is unattainable in ordinary two-roll operation.

The process, equipment and tooling required to handle high-strength steel, titanium alloys, aluminum and magnesium are almost identical except that the various metals cannot all be welded with the same reliability.

In the aviation field, which represents only a small segment of A. O. Smith's total production, the company has mass-produced such products as heavy bomb casings, aircraft landing gear for the B-17, B-29 and B-47; hollow steel propeller blades, and airframe structural parts. Among the latter were the intri-



Cost-Cutting Trunnion

Both of these pictures are of a B-47B front main landing gear trunnion. The big difference is that the upper trunnion, an alloy steel die forging contour-machined to keep weight at a minimum, took 900 man-hours to manufacture. Lower trunnion, a roll-forge weldment whose parts were fusion-welded together, took only 60 man-hours to make, and it weighs 15 lb. less. The upper trunnion was made to specification by Ladish Co., lower one by A. O. Smith.

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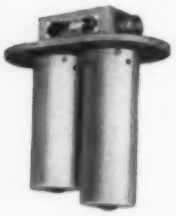

Ask for Engineering Bulletins 1050 and 1051, on new Revere single and dual float switches.

Revere CORPORATION OF AMERICA 6

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cate front and rear landing gear bulkheads for the B-52. Fifty-one sets were made. Other B-52 components made by the company include flap tracks, empennage supports, pod supports and stabilizer hinge supports.

When the company needs production machinery which is not available, it designs and builds its own. Examples are a 9,000-ton, single-action, high-speed, mechanical, precision forging press (which A. O. Smith says is the largest in the country) and a pair of 1,800-ton contour rolling mills capable of handling sheet sizes up to six ft. long and 30 in. wide (the only such mills in the country, according to the company).

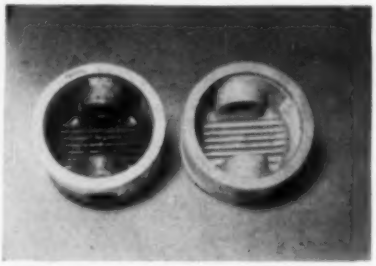
A. O. Smith has a West Coast division whose principal aeronautical activity is manufacturing stainless steel bomb ejectors for the Air Force and Navy as subcontractors to Douglas Aircraft Co.

The company has closed its landing gear manufacturing facilities at Toledo, Ohio, and Rochester, N. Y.

A. O. Smith developed and produced the first pressed steel automobile frame in 1902. Today, it knocks out this structure at the rate of one every 7½ seconds and has produced over 50 million to date.

The company claims to have made the first arc-welded, heavy-walled pressure vessel—opening a whole new range of design and processing possibilities for the oil and chemical industries; the first electric welded line pipe from formed plate—permitting mass production and making economically feasible long, cross-country gas and oil transmission lines.

The company's laboratories cover the field—metallurgy, welding, ceramics-organics, electricity, hydraulics, chemistry, spectroscopy, mass-spectrometry and X-ray diffractrometry.



Cleaner Engine Parts

This photo shows the crankcase side of an aircraft engine piston before and after Liquamatte cleaning. Liquamatte is a wet abrasive cleaner which, by the addition of a special detergent to the operating abrasive mixture, degreases and abrasive-cleans in a single operation, saving time and parts handling. It is available in several sizes and models from Wheelabrator Corp., Mishawaka, Ind.

SIX-FOOT SLOT on slow-drop parachute acts as nozzle, releases trapped air from canopy.

ARDC Designs Slotted, Slow-Drop Parachute

A new parachute featuring a slower drop and improved control during the descent has been developed for the Air Rescue Service by the Air Research and Development Command.

Major design feature of the new parachute is a six-foot slot up the back which acts as a nozzle to discharge the air trapped under the canopy. Pulling on the risers can change the shape of the exhaust nozzle to direct the chute to the left or right.

The parachute is a back type, put on like a vest. Adjustment is partially automatic during the process of putting the chute on. The back portion of the harness is upholstered from shoulders to hips with one inch of sponge rubber encased in heavy nylon.

Safety releases for water landings are located on each shoulder. The releasable canopy is an additional help should the jumper get hung in a tree. He ties the rope—which is standard equipment for a paramedic—to the canopy, releases his harness and slides down the rope.

ARDC has completed an extensive test program on the chute, including more than 500 live jumps. The first live jump was made by Chief Warrant Officer Edward J. Murray, the project officer.

The new parachute can be opened at speeds up to 175 mph. The current E-1 chute is limited to 130 mph. Rate of descent of the new chute is 16 fps. as compared with 21 fps. for the E-1.

After going into production, the parachute will be used to replace the dwindling supply of the now-standard E-1.

Curtiss Organizes Small Turbine Unit

Curtiss-Wright Corp. has organized a new Turbomotor Division for the development of engines of up to 7,500-lb. thrust for aircraft, helicopters, missiles and drone applications.

When the new division is in full operation, the parent company plans to split gas turbine operations, with the Wright Aeronautical Division concentrating on larger powerplants and the new group working on smaller units.

General manager of Turbomotor will be Emerson W. Conlon, former chairman of the Aeronautical Engineering Department at the University of

how to make a "Tiger" roar!

TELEFLEX® cable control assures positive throttle action on new Grumman F11F-1

Flashing into supersonic speeds, the pilot of the Navy's new Grumman Tiger jet gets instantaneous response when he gives it the gun. The throttle control that pours on the fuel is provided by a 20-foot Teleflex control linkage.

In designing the F11F-1, Grumman fighter built to pioneer in using the new "area rule," Grumman engineers wanted a throttle control system that would—

1. Meet handle load specifications
2. Be light and trouble-free
3. Be sensitive, accurate, reliable
4. Operate under the temperature extremes encountered in supersonic flight
5. Meet pressurization requirements

Easily installed Teleflex meets all these requirements . . . and more. The cable-in-conduit, mechanical remote control system follows a devious path through the F11F-1's fuselage to give throttle action that is accurate, positive. *Another* control problem solved with Teleflex!

TELEFLEX PRINCIPLE

Teleflex is a compact, single-path control linkage that follows any desired devious route. A flexible, rack-like cable, operating through precisely drawn conduit, transfers linear, arc, or rotary controlling motion as tension or compression push-pull motion. Wherever rotary motion (up to a full revolution or more) is required, the cable helix meshes with and turns a hobbed control wheel.

DESIGN ENGINEERS: For detailed engineering data, write to TELEFLEX INCORPORATED, 125 S. Main Street, North Wales 9, Pa., for your copy of Catalog 400.

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LINKAGES MECHANISMS

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Michigan, and one of the founders of the Willow Run Research Center and its associated Aircraft Propulsion Laboratory. The chief engineer, Norman C. Witbeck, was most recently with Fairchild Engine Division, and before that served as executive director of the Panel of Aircraft Propulsion in the Office of the Secretary of Defense, and manager of General Electric's Aerodynamic Development Section.

The new division is temporarily located at Hempstead, N. Y., while a staff is being organized and a permanent site sought. Witbeck says present plans call for a payroll of 4,000-5,000 employees. The new division will have its own facilities for component development and full-scale engine test.

Organization of the new division followed Curtiss-Wright's acquisition of Turbomotor Associates, Hempstead.

USAF Contracts

Following is a list of unclassified contracts for $25,000 and over as released by Air Force Contracting Offices:

AIR MATERIEL COMMAND, Wright-Patterson AFB, Ohio.

Lockheed Aircraft Corp., Marietta, Ga., facilities for production of C-130 aircraft and modification of B-47 aircraft, (PR's 636422 and 672962), $875,000.

Delco Products, Dayton, Ohio, storage and maintenance of facilities, (PR 226083), $126,000.

Ramo-Wooldridge Corp., 8820 Bellanca Ave., Los Angeles 45, Calif., purchase of real property, (PR 672964), $1,230,000.

Continental Aviation and Engineering Corp., Detroit 32, Mich., conversion of facilities for the testing of J69 engines and MA-1 gas turbine air compressors, (PR 636466), $40,000.

Pratt & Whitney Engine Div., East Hartford 8, Conn., manufacture, design, acquisition, supply and installation of facilities, (PR 225933), $589,000.

Ryan Aeronautical Co., Lindbergh Field, San Diego, Calif., type Q-2A drones and delivery stretch-out of drones (PR's 225764 and 142806), $1,039,184; acquisition of facilities (PR 709735), $100,000.

Link Aviation, Inc., Binghamton, N. Y., F-102A flight simulators, spare parts, tools and data, (PR PH-235958), $8,198,731.

North American Aviation, Inc., 12214 Lakewood Blvd., Downey, Calif., partial overrun XSM-64 missiles, (PR PH-709565), $10,000,000.

ACF Industries, Engineering and Research, Hyattsville, Md., B-57B flight simulators, spare parts, special tools, engineering and technical data, (PR PH-96925), $2,489,143.

Curtiss-Wright Corp., Electronics Div., 631 Central Ave., Carlstadt, N. J., C-133A trainer, flight simulator type MB-16, (PR 143574), $1,239,669; trainers, flight simulator, type MB-12, for C-130A aircraft, (PR PH-205044), $250,000.

Thompson Products, Inc., 23555 Euclid Ave., Cleveland, Ohio, acquisition of facilities, (PR 672934), $1,000,000.

General Electric Co., Syracuse, N. Y., facilities for the maintenance and overhaul of the radar network, (PR 573348), $128,-840.

Convair Division, Fort Worth, Tex., facilities for the research and development of project MX 1589, (PR 272966), $558,000.

Steel Products Engineering Co., Springfield, Ohio, removal and preparation for shipment of facilities, (PR 148852), $20,-000.

Boeing Airplane Co., Seattle, Wash., facilities for the production and modification of B-52 aircraft, (PR 672963), $5,072,213.

University of Dayton, Dayton, Ohio, ac-

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quisition of facilities to support production under various Air Force research and development contracts, (PR's 149387 and 102213), $60,562.

Solar Aircraft Co., San Diego, Calif., acquisition of facilities, (PR 708728), $300,000.

Kelsey-Hayes Wheel Co., Detroit, Mich., acquisition of installation of facilities for the production of J57 engine components, (PR 636465), $300,000.

Oneida Ltd., Oneida, N. Y., acquisition, rehabilitation and installation of machinery and equipment, (PR 672930), $74,300; acquisition of facilities, (PR 636492), $300,000.

Ramo-Wooldridge Corp., 8820 Bellanca Ave., Los Angeles 45, Calif., facilities for technical assistance, (PR's 148966 and 199235), $30,000.

Stroukoff Aircraft Corp., West Trenton, N. J., rehabilitation and installation of Hydropress, (PR 672968), $35,000.

MIDDLETOWN AMA, Olmsted Air Force Base, Middletown, Pa.

Avco Mfg. Corp., Lycoming Div., 550 Main St., Stratford, Conn., unpacking, disassembly, retrofit, test and repacking 54 R1820-84 engines, (PR 598195), $32,803.

Garwin Inc., 918 Dooley St., Wichita 12, Kan., overhaul and repair of indicators, thermocouple, (PR 598096), $27,188.

Lam Bldg. Corp., 1001 Wood St., Philadelphia 7, Pa., construction of reinforced concrete foundations and cable troughs and erection of AB 258 temperate type steel tower at Palermo, N. J., (PR (MANN) 56-54-1), $34,984.

United States Department of the Interior, Bureau of Mines, Helium Activity, P. O. Box 911, Amarillo, Tex., helium, filling charge per cylinder and estimated service charge on AF cylinder maintenance, (PR 662011), $136,500.

Decker Aviation Corp., 1361 Frankford Ave., Philadelphia, Pa., repair of components of type F-5 autopilot system (PR 598192), $284,139.

OFFICE OF SCIENTIFIC RESEARCH, Air Research and Development Command, P. O. Box 1395, Baltimore 3, Md.

Regents of the University of Minnesota, Minneapolis 14, Minn., nuclear and paramagnetic resonance studies (AF 18 (600)-479), job, $49,482.

Regents of the University of Minnesota, Minneapolis 14, Minn., study of direct measurements of shearing stress (AF 18 (600)-384), job, $49,482.

Navy Contracts

Following is a list of unclassified contracts of $25,000 and over as released by Navy Contracting Offices:

BUREAU of AERONAUTICS, Washington, D. C.

Aeroprojects, Inc., 310 E. Rosedale Ave., West Chester, Pa., design, construct and install on a standard resistance welding machine equipment capable of applying ultrasonic energy during resistance welding to determine the optimum conditions for seam and area welding of structural aluminum alloys, reports, NOas 56-161-c, (AE-41-1842-56), $29,577.

Federal Electric Corp., 100 Kingsland Road, Clifton, N. J., furnish 60 man-months of field engineering services in connection with the assembling, altering, repairing or operating, or assisting or giving instructions with respect thereto of aircraft electrical and electronic equipment, NOas 56-113-s, (MA-35-4415-56), $80,268.

Syracuse University (Institute of Industrial Research), Syracuse 10, N. Y., services and materials necessary to investigate the sources, extent and methods of alleviation of residual stresses in steels heat-treated to very high strength levels, and the relations between residual stresses and hydrogen embrittlement in high-strength steels, NOas 56-152-d(AE-41-1844-56), $50,000.

Beech Aircraft Corp., Wichita, Kan., services of two factory-trained field service technicians to serve as field instructors to instruct Naval and Marine Corps personnel in the operation, maintenance and servicing of T-34B aircraft, NOas 56-153-s (MA-33-4432-56), $26,792.

CAB Report on DC-3 Collision With Cessna 140

Crews, Tower Erred in Traffic Procedure

At 1014,[1] July 12, 1955, a Trans World Airlines Douglas DC-3, N 51167, and a Baker Flying Service Cessna 140A, N 1158D, collided in flight approximately two miles north-northwest of the Fairfax Airport Control Tower, Kansas City, Kansas.

The Cessna crashed following the collision and its two occupants were fatally injured.

The DC-3, substantially damaged, landed safely at the Fairfax Airport. Its captain and first officer, the only persons on board, were not injured. No fire was involved.

On July 12, 1955, Trans World Airlines' DC-3, N 51167, designated as Plane 323, was scheduled for a pilot re-qualification check flight. First Officer Robert L. Horton, the recipient of this check flight, flew the aircraft from the left pilot's seat and Captain Henry D. Orr, check pilot, occupied the right pilot's seat. The first portion of the check was to include two touch-and-go landings at the Fairfax Airport, Kansas City, Kansas. The elevation of this airport is 746 feet.

HISTORY OF THE FLIGHT

At 1001, TWA 323 took off from runway 3 of the Kansas City Municipal Airport,[2] Kansas City, Missouri. A slight right turn was made after takeoff to comply with the noise abatement route and at about 2,000 feet a left turn was started toward the Fairfax Airport.

At this time Captain Orr called the Fairfax control tower on 119.1 mc., gave his position as north-northeast of the field, and requested clearance to make two touch-and-go landings. Accordingly, the Fairfax tower cleared the flight to enter a left traffic pattern for runway 35. On the downwind leg for that runway the flight was cleared for a touch-and-go landing.

At approximately 1011, TWA 323 touch down, following which a normal takeoff was made. The landing gear was retracted and when 1,050 feet was reached power was reduced from 42" of manifold pressure to 39". At an altitude of about 1,250 feet and an indicated airspeed of 105 knots, power was further reduced to 32" manifold pressure and propeller settings were changed from 2,450 rpm. to 2,050 rpm.

According to the crew, a left climbing turn was then begun. At approximately 105 knots, on a heading of approximately 200 degrees, and at an altitude of between 1,750 and 1,900 feet, the pilots heard a noise similar to an explosion and felt the aircraft swerve suddenly to the left. The swerve returned the airplane to level flight degrees. Captain Orr took over the controls at once.

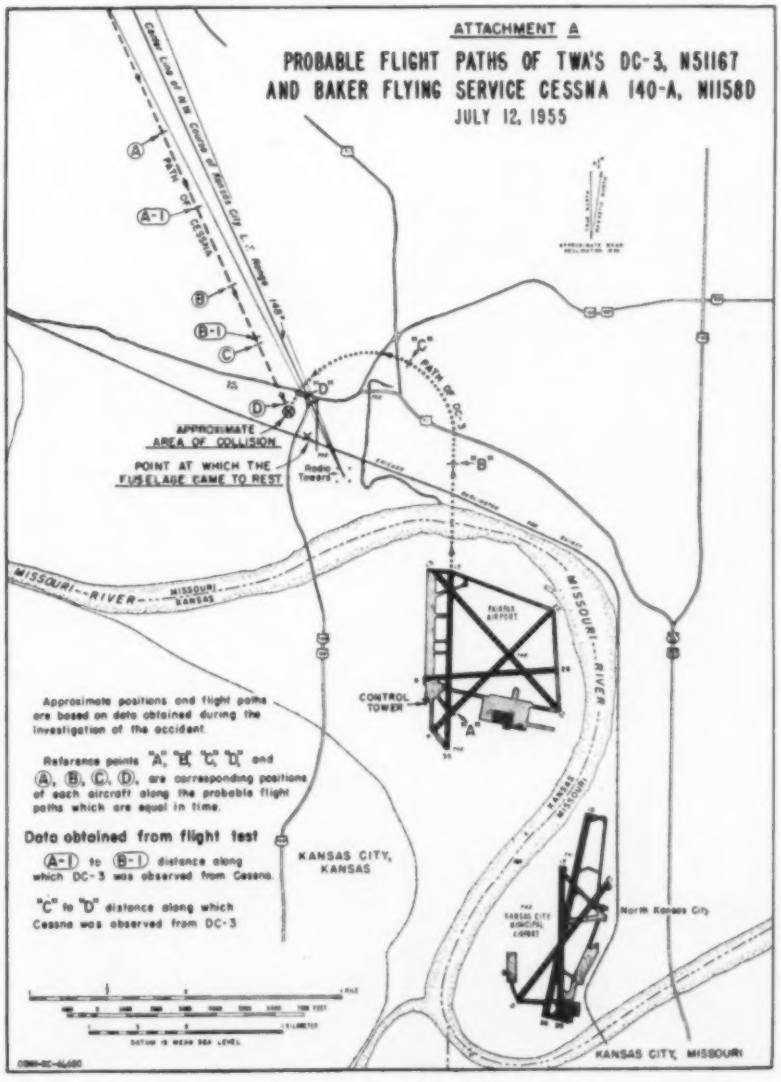
Immediately the Fairfax tower controller called the flight and advised that he thought it had collided with a Cessna. He cleared the DC-3 to land on either runway 4 or 8, and a landing was made on runway 8.

Cessna Training Flight

At 0830, the morning of the same day, a Cessna 140A, N 1158D, (referred to hereafter as N 58D) operated by the Baker Flying Service, departed the Municipal Airport on an instrument training flight. The flight was to include practice in range orientation and simulated instrument approaches. In the left seat was Student Samuel H. Rempel, with Flight Instructor Thomas D. Jones occupying the right seat.

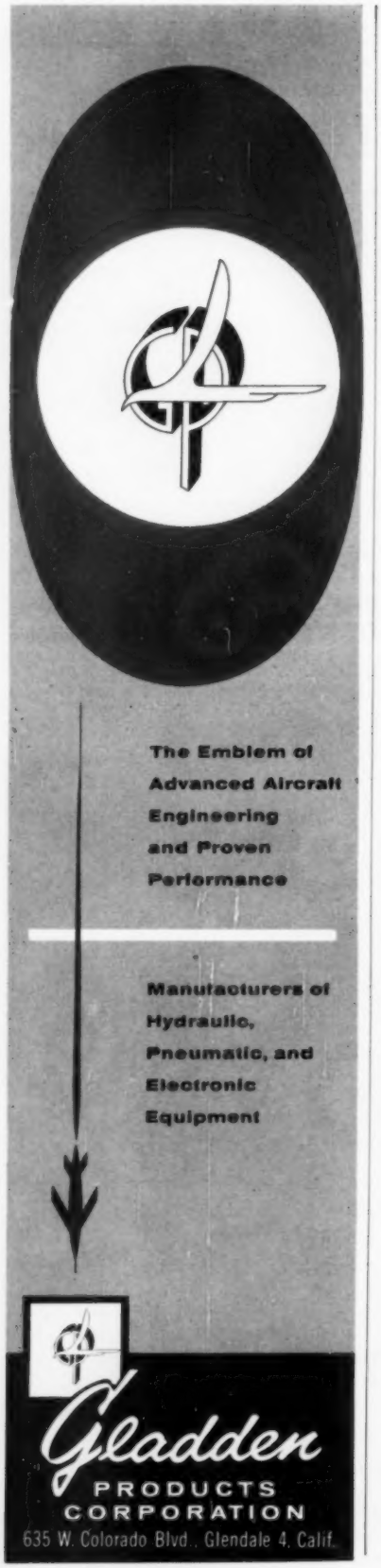
At 0945 the flight called the Fairfax tower on 119.1 mc., gave its position as over the low frequency range station, and requested clearance to make a simulated low frequency range approach. This was granted and the flight was advised to report upon completion of its procedure turn inbound. N 58D reported as directed and after passing the range station the pilot executed a miss-approach procedure and disappeared from the tower controller's view, heading west.

At 1002 N 58D again called the Fairfax tower, gave its position as over the range station, altitude of 3,000 feet, and requested clearance to make another simulated low frequency range approach. This


ATTACHMENT A
PROBABLE FLIGHT PATHS OF TWA'S DC-3, N51167
AND BAKER FLYING SERVICE CESSNA 140-A, N1158D
JULY 12, 1955
PATH OF CESSNA
PATH OF DC-3
APPROXIMATE AREA OF COLLISION
POINT AT WHICH THE FUSELAGE CAME TO REST
Radio Towers
MISSOURI--RIVER--MISSOURI-KANSAS
CONTROL TOWER
Approximate positions and flight paths are based on data obtained during the investigation of the accident.
Reference points "A", "B", "C", "D" and (A), (B), (C), (D), are corresponding positions of each aircraft along the probable flight paths which are equal in time.
Data obtained from flight test
(A-1) to (B-1) distance along which DC-3 was observed from Cessna.
"C" to "D" distance along which Cessna was observed from DC-3
KANSAS CITY, KANSAS
North Kansas City
KANSAS CITY, MISSOURI

[1] All times herein are Central Standard and are based on the 24-hour clock; all altitudes are mean sea level, and all headings are magnetic.

[2] The Kansas City Municipal Airport and the Fairfax Airport are about 1½ miles apart and separated by the Missouri River, and placed it on a heading of about 170



call was made on a radio frequency of 122.5 mc. The tower answered, simultaneously using radio frequencies 278 kc. and 119.1 mc., as follows, "N 1158D Fairfax tower, cleared for low frequency simulated range approach, cleared for runway 13. Call procedure turn inbound."

This was acknowledged and was the last radio contact with the aircraft. N 58D was not heard to report inbound and the controllers scanned the sky to the northwest but were unable to see it. At 1014 they observed TWA 323 north of the tower making a turn to the southwest and saw yellow objects falling below and behind it. As N 58D was yellow they concluded that it was involved in a collision.

The weather recorded a few minutes after the accident was: Clear; visibility 10 miles; wind east-northeast 10 knots.

INVESTIGATION

The Cessna sustained severe damage during the inflight collision and subsequent ground impact. Its wreckage was found strewn near the intersection of U. S. Highway 69/169 and the Burlington Railroad tracks. Small portions of the fuselage and the left and right wing structure, together with many other portions of the aircraft, were found in an area 900 feet long and 600 feet wide west of the highway.

The main portion of the fuselage, with the empennage and stub portion of the right wing still attached, contacted the ground east of the highway. No parts were found south of the tracks. Examination of the entire wreckage accounted for all components of the aircraft and showed no evidence of structural failure or malfunctioning prior to the collision.

The Cessna wreckage was transported to a suitable location where it was laid out for a more detailed examination in an effort to determine the manner in which the two aircraft came together.

The most significant of many inflight impact markings was a series of 11 propeller cuts on the left wing, cabin, and right wing. These were essentially parallel and almost evenly spaced. The force of the cuts destroyed the structural integrity of both wings while the aircraft was in flight and in such a manner that the left wing was severed in five pieces and the right wing in two.

Examination of the cuts revealed typical skin curlings and feathering associated with high-speed cuts made by the DC-3's left propeller rotating clockwise as it moved over the Cessna from left to right.

There were gouges and scratches on the blades of the Cessna propeller. The tip section of one of the blades had separated in flight and was found on the west side of the highway. It was determined that these propeller blade markings were made when the propeller contacted the leading edge and bottom surface of the DC-3's left wing.

The DC-3 was substantially damaged. The major damage was confined to the left propeller, the left oil cooler scoop, and the left wing outboard of the nacelle. The leading edge of this wing was badly damaged and two propeller cuts were found in it. Other portions of the wing bore numerous scuff marks, cuts, and scratches. Blue and yellow paint, the color scheme of the Cessna, was observed in many places. Small pieces of the left and right wing panels of the Cessna were hanging from the DC-3 and embedded in tears near its left landing light.

The left propeller blades of the DC-3 were gouged along their leading edges and both sides of the blades showed yellow and blue paint. The lower and outboard leading edges of the left oil cooler scoop were crushed rearward and also showed evidence of paint from the Cessna.

Examination of the DC-3 and testimony of the crew revealed there was no malfunction or failure of the aircraft or its components prior to the initial impact.

Avionics Equipment

Examination of the Cessna VHF radio transmitter revealed that the shaft of the frequency selector switch was displaced rearward and jammed. It could be rotated a distance of approximately one frequency selection only. The switch was in a position to select 119.1 mc., the frequency normally used in contacting the Fairfax tower. The VHF receiver was badly crushed by impact so that the tuning condenser was deformed and the fixed and movable plates were pressed together. The frequency setting of this radio unit could not be determined.

The low frequency receiver of the Cessna aircraft sustained severe impact damage. The selector switch was set to "range" position and jammed. Examination revealed that the unit was jammed on 355 kc., approximately that of the Kansas City low frequency range (359 kc.).

The Cessna was equipped to transmit on VHF frequencies 118.3 mc., 119.1 mc., 122.1 mc., 122.5 mc. and 121.5 mc. It could receive on these frequencies as well as on common low frequencies.

On the day of the accident the crew of N 58D contacted Fairfax tower using 119.1 mc. throughout the first approach. During the second approach the tower was contacted on 122.5 mc. when the Cessna reported over the low frequency range station and asked permission to make the approach.

This was learned by examination of the recordings made of all transmissions on this frequency in the nearby municipal tower.

The Fairfax tower was equipped with numerous transmitting and receiving frequencies. With respect to the request for the simulated instrument approach made by the Cessna crew, however, the tower answered on 119.1 mc., with a portion of the reply being transmitted simultaneously on 278 kc. until that transmitter key was opened, ending the transmission on that frequency. This was done during the transmission just before the portion when N 58D was requested to report inbound on its procedure turn.

Might Have Missed Clearance

Investigation disclosed that the low frequency receiver was tuned to the Kansas City low frequency range at the time of the accident; however, if the Cessna was receiving on 278 kc. only at the time the clearance was issued, its crew would not have heard the instruction to report on the procedure turn inbound. If the VHF receiver was tuned to 119.1, the pilots would

have heard the complete clearance.

The crew of the DC-3 took off from Kansas City Municipal Airport at 1001 using tower frequency 118.3 mc. After climbing to about 2,000 feet they changed to the Fairfax tower frequency of 119.1 mc. and requested clearance to enter the Fairfax traffic pattern for runway 35. The DC-3 crew could not hear communication between the tower and the Cessna on 119.1 mc. because it occurred while the DC-3 was still tuned to 118.3 mc. The crew of the DC-3 also stated that they did not know N 58D was making the approach.

The Kansas City low frequency range station is located .7 statute miles northwest from the approach end of runway 13. The low frequency range instrument approach procedure used by Baker Flying Service provides that the aircraft pass over the range station at 3,000 feet, then proceed outbound on the northwest range leg (328 degrees) for approximately seven miles. It then requires a procedure turn on the east side of the range leg and return to the low frequency range station on the same leg using approximately a reciprocal course. During this time a descent is made to 1,600 feet.

The approved VFR departure pattern on runway 35 of the Fairfax Airport for aircraft above 12,500 pounds gross weight prescribes a left turn as soon as practicable after takeoff to a magnetic heading of 330 degrees, climbing to at least 2,000 feet before making any other turns or proceeding on course.

Two Controllers on Duty

During the accident period there were two controllers on duty in the Fairfax tower. Traffic was light and weather conditions were clear with visibility approximately 10 miles.

The approach controller stated that when N 58D requested the second simulated instrument approach he issued the clearance and had prepared a progress strip for the flight. The strip has spaces for the time the flight reported inbound on the procedure turn and the arrival time over the range inbound. The controller noted that transmissions from N 58D were a little weak. He stated that while issuing the clearance he terminated the transmission on 278 kc. feeling sure that the aircraft was listening on 119.1 mc. frequency. The flight acknowledged the clearance.

The local controller in the meantime was controlling other traffic, including the DC-3. He testified that after the DC-3 became airborne following the touch-and-go landing, he asked the other controller if the Cessna had reported on its procedure turn, noting that the time had not been recorded on the progress strip. Informed that it had not, both controllers, realizing it was an important traffic factor, looked for the Cessna in the area of the range station. Neither saw it but both were able to see TWA 323 in a left climbing turn north of the tower.

The local controller then turned to check the separation between the DC-3 and another Cessna making touch-and-go landings. Noting there was good separation he again looked for N 58D. He then saw the DC-3 just northwest of the range station

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and at the same time saw yellow falling objects below and behind it. At no time was advisory information offered either the DC-3 crew or the Cessna crew relative to the presence and activity of the other.

Instrument Flight Training

Officials of Baker Flying Service testified during the public hearing that they offered various phases of flying training. They also explained that under a contractual agreement with TWA they gave an instrument flight training course to the airline's newly hired first officers. The purpose of the contract was to give sufficient training to these pilots so they could obtain a CAA instrument rating.

At the time of the accident the instrument training given each of these students depended on his degree of proficiency, which varied among the students according to his prior experience and training. The program included supervised flight during which the student practiced IFR (Instrument Flight Rules) voice procedures, orientation procedures, and the use of instrument facilities, and maintained precise control of the aircraft solely by reference to instruments in the aircraft. The instructor monitored the student's performance, instructed him in the training phases, and acted as the safety pilot for the flight. Mr. Rempel was one of the TWA's trainees at the time of the accident.

The Cessna was used for the instrument flight training. The aircraft, a single-engine high-wing monoplane, was fitted with a cockpit instrument training hood to prevent outside vision by the trainee, thereby requiring him to fly solely by reference to instruments. The hood consisted of a rubberized cloth extending downward from the cabin top and diagonally across in front of the student. The left side window was covered by a louvre type blind. The trainee's vision to the right was also blocked by the diagonal blind and the instructor seated beside him.

Construction of the hood permitted the instructor to see outside the aircraft. Although his vision was obstructed to some degree he could maintain a lookout with some movement of his body not normally necessary without the hood. This hood was within the requirements specified.[8]

Outside vision is necessary because much of the instrument training is conducted during good weather conditions. A flight under such conditions is considered a VFR (Visual Flight Rules) flight and the responsibility for separation between aircraft rests on the pilots to see and avoid the other. The CAA Flight Information Manual states in part: "When flying in VFR weather conditions (regardless of the type flight plan or air traffic clearance) it is the direct responsibility of the pilot to avoid collision with other aircraft."

Tests were conducted when weather conditions and wind factors were nearly identical to those on the date of the acci-

[8] CAA Manual of Procedure:
"The term proper hood is construed to to mean a hood which will completely exclude all outside visual reference to the pilot on instruments yet not unduly restrict vision of the safety pilot, agent, or examiner. Sufficient visibility to permit clearance for turns in either direction, as well as adequate forward visibility is required . . . ."

dent. The time of these tests was also comparable to the time of the accident.

A DC-3 was flown in conformity to the same configuration used by Flight 323, based on the information given by its crew and in conjunction with the observations given by the numerous eyewitnesses.

A Cessna was flown in conformity to the final approach portion of the standard low frequency radio range approach inbound to the station and at speeds normal for that aircraft. An identical instrument training hood was used on the Cessna.

The flights were also timed so that their flight paths intersected at the position in space approximately where TWA 323 and N 58D collided. The test aircraft used only minimum safe altitude separation to keep that variable to the smallest effect. The purpose of these flight tests was to obtain, as accurately as possible a reconstruction of the flight paths of the accident aircraft and to learn when, how long, and in what relative positions each aircraft was visible to the crew of the other.

Board personnel were present on each aircraft as observers. During the tests other Board personnel watched from the control tower to learn whether or not the aircraft could be seen from there and if so what difficulties were experienced in locating and following them visually.

During the tests the Cessna was first seen from the DC-3 by the pilot seated in the left seat. This occurred when the DC-3 was about 23 seconds from the approximate collision position and while it was making the left climbing turn through about 300 degrees magnetic. There was then approximately one mile separation between the two aircraft. The Cessna remained visible to this pilot through the left front windshield panel for 17 seconds, during which time the Cessna moved from the left center of this windshield toward the bottom edge. It disappeared from view at the bottom of the windshield panel near the center post which divided the entire windshield.

Visibility From DC-3

The tests disclosed that the Board observer in the right seat of the DC-3 first observed the Cessna during the same left climbing turn about 16 seconds from the collision position. The Cessna was then estimated to be about 3,500 feet away. The Cessna remained visible to this observer through the right front windshield panel for about 13 seconds, at the end of which time the Cessna was estimated to be about 600 feet from the DC-3. During this time the Cessna moved from the lower left center of the windshield panel diagonally toward its bottom edge, continuing until it disappeared below the edge near the center of the windshield panel.

From the Cessna, with the instrument hood in place, there was no opportunity during the tests for the pilot in the left seat to see the DC-3. From the observer's or instructor's seat the DC-3 could be seen for 29 seconds; however, in order to do so it was necessary for that pilot to lean forward enough to see along the front plane of the hood component installed in front of the trainee-pilot seat. It was testified that observer-pilot always assumed this position.

During the time the DC-3 was visible it

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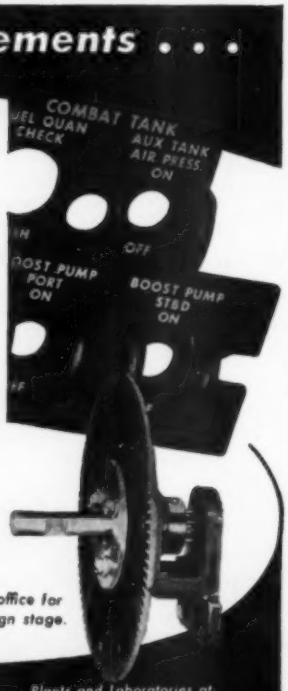

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moved from alongside the compass across the lower center of the windshield parallel to the glare shield toward the left door post, where it disappeared. The CAB observer said that at no time while observing the DC-3 did it appear to be on a collision course with his aircraft.

All the participants said that, throughout the series of six flight tests, the position of the sun did not cause glare. Each stated that knowing in advance the position of the other aircraft was of material assistance in sighting it when they did.

During these tests the time was almost identical when each aircraft was first sighted by the observer in the other. Repeated test flights did not improve the ability of the pilots to locate the other aircraft more quickly. The participants were impressed with the difficulties in seeing each other.

Hard to See From Tower

The observer in the tower stated that from that position the DC-3 was clearly visible and could be easily located during the entire series of flight tests. The Cessna beyond three miles was extremely hard to see and follow while it was proceeding either directly toward or away from the range station.

When the Cessna was proceeding inbound it first appeared to be so small and far away that it seemed unlikely that both it and the DC-3 would arrive at the collision point at the same time. It was only during the last few seconds prior to arrival over the collision point that the Cessna appeared to be in close proximity to the DC-3.

The investigation included an exhaustive search for eyewitnesses to the collision. Many persons in the immediate area were contacted and gave statements concerning their observations. Nearly all agreed that the weather was clear and that visibility was good in all directions. Those best positioned to observe the aircraft stated that the DC-3 appeared to be heading south or south-southwest.

Witnesses who saw the Cessna saw it only a few seconds before impact. They said it appeared to be flying southeast just before the accident. They also said the collision did not seem imminent until a few seconds before it occurred. Others stated that even then there appeared to be vertical separation between the aircraft. None saw either aircraft take evasive action. Many observed components of the Cessna separate during the impact and stated it plunged to the ground immediately.

ANALYSIS

At the time of the accident, weather conditions were clear and the visibility was at least 10 miles. Weather was therefore no factor.

Considering all the available evidence it is probable that the Cessna pilots heard the tower clear them for a simulated low frequency range approach, including the instruction to report on the procedure turn inbound. It is believed that this was heard on 119.1 mc. because the low frequency receiver was probably then being used for navigational purposes and would not have

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been available for receiving the tower on 278 kc.

As previously stated the tower controllers did not receive a report on the procedure turn from N 58D. This is substantiated by the lack of a recorded tower transmission on 119.1 in response to such a call which would have been recorded in the Fairfax tower. Had N 58D reported on any other frequency, such as 122.5, this would have been recorded by the Municipal tower.

Since there was no recorded response from the tower or recorded transmission from the aircraft, it is believed that the pilot of N 58D did not report as requested or the transmission, for mechanical reasons, could not be made or did not reach the tower. Although the radio equipment of this aircraft was severely damaged, it is believed that normal operation could have been expected before impact.

DC-3 Not Advised

Since the Cessna flight had been instructed to report on the procedure turn, it is reasonable for the tower personnel to have expected it to do so, thereby alerting them to its position. Although they did not receive the report, after a reasonable time both controllers attempted to locate the Cessna visually but were unable to do so.

Considering the distance, the head-on view presented by the Cessna, and other factors affecting their ability to locate it, the Board is of the opinion that it is not unreasonable for them to have failed to see it.

With respect to advisory information, it is believed that the tower personnel did not carry out their full function. Both controllers knew that the Cessna was conducting an instrument approach and that it could be expected by time expiration to be in the latter portion of the procedure and would be an important traffic factor at that time. It is believed that under these conditions the DC-3 crew should have been advised during the touch-and-go landing clearance that N 58D was making a simulated approach and might be expected as a traffic factor.

In determining whether or not each aircraft could have been seen from the other and the collision thus avoided, several factors must be considered. The first is the angular limits of cockpit vision. This factor is the opportunity to see another object afforded by the cockpit structure only.

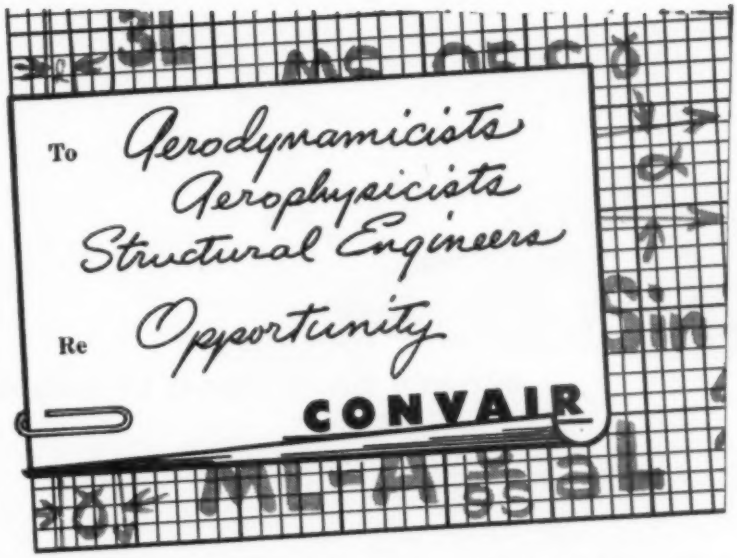
A second factor is visual range or the distance that an object can be seen. This includes the angular size and shape of the object, its background contrast, the degree of lighting, and apparent motion of the object.

A third factor is the time element during which the object is within the angular visual limits of the cockpit and within visual range.

Finally, consideration must be given to the numerous physiological factors affecting the human ability to locate and see an object.

Departure From Pattern

The DC-3's climb-out following a touch-and-go landing was not in accordance with the airport's approved traffic pattern, in that a climbing left turn was made instead



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of climbing on a heading of 330 degrees magnetic until reaching an altitude of 2,000 feet.

If the proper pattern had been flown the DC-3 might have passed over the collision area; however, the aircraft's altitude then would have been 2,000 feet. Also, the aircraft would have been in level flight after reaching this altitude and making the left turn, thereby affording both pilots a broader field of vision.

The clearance issued by the tower to the DC-3 to make touch-and-go landings does not constitute a waiver to deviate from the approved traffic pattern.

As shown by the flight tests it is clear that both crews of the accident flights were afforded the opportunity to see the other's aircraft and although the time element during which this opportunity existed was not long, it was adequate.

It is recognized that the time elements as shown by the test flights were obtained by pilots who were primarily engaged in locating the other aircraft, knew where it should be at all times, its altitudes, and the track it was going to follow. This knowledge aided the test crews in sighting the other aircraft.

CAR Requirement

Civil Air Regulations[4] clearly state the responsibility of pilots to observe and avoid other aircraft. Under these regulations it was the responsibility of both crews to see the other's aircraft and for the DC-3 crew to take evasive action as it converged on the Cessna from the left and rear. This responsibility also rested with the Cessna safety pilot as the flight entered the traffic pattern area in close proximity to the DC-3 already operating in the pattern.

With regard to the various factors affecting observance of traffic, it must be recognized that both flight crews were engaged in flight activity which by their nature would require a diversion of attention both within and outside the respective cockpits.

The qualification check flight would, by its precise nature, require considerable attention inside the DC-3 cockpit by both the pilot flying the aircraft and the check pilot observing him.

In the case of the Cessna only the instructor would be able to see the DC-3. His responsibility was certainly divided be-

[4] "60.12 Careless or reckless operation: No person shall operate an aircraft in a careless or reckless manner so as to endanger the life or property of others.

"(c) Lack of vigilance by the pilot to observe and avoid other air traffic. In this respect, the pilot must clear his position prior to starting any maneuver, either on the ground or in flight."

"60.14 (d) Overtaking. An aircraft that is being overtaken has the right-of-way, and the overtaking aircraft, whether climbing, descending, or in horizontal flight, shall keep out of the way of the other aircraft by altering its course to the right, and no subsequent change in the relative positions of the two aircraft shall absolve the overtaking aircraft from this obligation until it is entirely past and clear . . ."

"60.15 Proximity of aircraft. No person shall operate an aircraft in such proximity to other aircraft as to create a collision hazard. No person shall operate an aircraft in formation flight when passengers are carried for hire. No aircraft shall be operated in formation flight except by prearrangement between the pilots in command of such aircraft."

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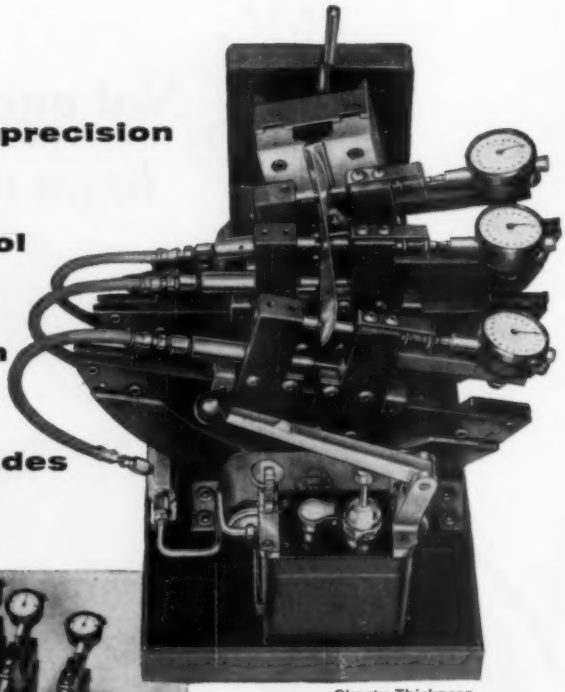

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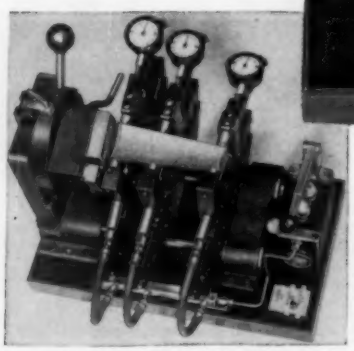

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tween watching for other aircraft and the duties of an instrument flight instructor. Many of these duties would result in checking the cockpit instruments and techniques of the student.

The Board recognizes the aforementioned factors which made it difficult for these pilots to see the other aircraft and acknowledge that to do so required the highest degree of vigilance. However, the Board expects flight crews to exercise the utmost vigilance in order to carry out their responsibility and is of the opinion that if both crews in this instance had maintained a lookout commensurate with their responsibility this accident could have been averted.

As a result of this accident the Board's Bureau of Safety Regulation is studying the Civil Air Regulations to see if any revision or modification is necessary.

FINDINGS

On the basis of all available evidence the Board finds that:

1. Trans World Airlines, its crew, and aircraft were currently certificated and the flight was properly dispatched.

2. The Baker Flying Service flight was dispatched according to an authorized activity of the organization and both pilots were certificated for an instrument training flight.

3. Both aircraft were properly maintained and there was no evidence of structural failure or malfunction prior to the collision.

4. At the time of the acident the DC-3 was engaged in touch-and-go landings and the Cessna was making a simulated instrument approach using the Kansas City low frequency radio range.

5. The Cessna flight was given a standard clearance for the approach and was requested to report on the procedure turn inbound; this was acknowledged.

6. The tower personnel did not receive a report from the Cessna during the procedure turn.

7. The DC-3 did not fly acording to the approved traffic pattern of the airport.

8. The collision took place at a position which was normal for the Cessna during the later part of the simulated instrument approach.

9. Evidence indicated there was no evasive action taken by either crew.

10. No advisory information was given either crew by the tower with respect to the other's presence.

11. For a short period of time both crews could have seen the other's aircraft along its flight path.

12. The position of the sun and the weather conditions were not factors in the accident.

PROBABLE CAUSE

The Board determines that the probable cause of this acident was the failure of the DC-3 crew to observe the Cessna and to comply with the prescribed airport traffic pattern which resulted in their converging and overtaking it. Contributing factors were the failure of the tower controller to advise the DC-3 that the Cessna was making a simulated instrument approach and the

failure of the instructor-pilot of the Cessna to report inbound, and to see and avoid the other aircraft.

By the Civil Aeronautics Board:

Ross Rizley
Joseph P. Adams
Chan Gurney
Harmar D. Denny

SUPPLEMENTAL DATA

The Civil Aeronautics Board was notified of this accident at 1120, July 12, 1955. An investigation was immediately begun in accordance with the provisions of Section 702 (a) (2) of the Civil Aeronautics Act of 1938, as amended. A public hearing was held July 28 and 29, 1955, and reopened to receive additional information on September 13, 1955.

Air Carrier and Baker Flying Service

Trans World Airlines, Inc., is a scheduled air carrier incorporated in the State of Delaware with its principal offices located at Kansas City, Missouri. It operates under a currently effective certificate of public convenience and necessity issued by the Civil Aeronautics Board and an air carrier operating certificate issued by the Civil Aeronautics Administration. These authorize the company to transport by air persons and property over numerous routes.

The Baker Flying Service, owned and operated by Wilbert N. Baker, is located on the Kansas City Municipal Airport and was organized in October 1944. The organization holds an approved school certificate issued by the Civil Aeronautics Administration and is approved to train pilots for private, commercial, instructor, and instrument ratings. This function is carried out with seven aircraft operated by the organization.

Flight Personnel

• **Baker Flying Service.** Mr. Thomas D. Jones, age 28, held a currently effective airman certificate with commercial, instructor, and instrument ratings and a rating for the aircraft involved. He had been employed by Mr. Baker since 1953. Mr. Jones had logged 3,086 flying hours since 1944, of which nearly 2,000 hours were in the type aircraft involved. His last physical examination was completed October 16, 1954.

• **Trans World Airlines.** Captain Henry D. Orr, age 44, held a currently effective airline transport rating with an appropriate rating for the subject aircraft. He was employed by the company January 2, 1941. Captain Orr had accumulated 15,397 flying hours, of which 5,716 were in the DC-3 type aircraft. His last physical examination was completed April 25, 1955.

First Officer Robert L. Horton, age 28, held a currently effective airman certificate with commercial pilot and instrument ratings. He was employed by Trans World Airlines May 18, 1953. First Officer Horton had accumulated 3,450 flying hours, of which 82 hours were in the DC-3 and 800 hours in other twin-engine aircraft. His last CAA physical examination was accomplished May 24, 1955.

Mr. Samuel H. Rempel, age 25, the student copilot of the Cessna, was employed by Trans World Airlines as a student copilot May 31, 1955. He had 1,403 flying hours, of which seven hours were in the Cessna 140 aircraft. Mr. Rempel held a currently effective airman certificate with a commercial rating. His last physical examination was completed May 4, 1955.

The Aircraft

The Douglas DC-3 bore manufacturer's serial number 7384. The airframe had accumulated 16,328 total flying hours. The engines were Pratt and Whitney S1C-3G and the propellers were Hamilton Standard.

The Cessna 140A was leased by the Baker Flying Service in June 1955. The airframe had accumulated 2,191 hours, of which 81 were since the last 100-hour engine and airframe inspection. The aircraft had received an annual inspection April 2, 1955.

F-100D Spares Order

North American Aviation, Inc., has received a $25 million Air Force order for F-100D aircraft, spare parts and related equipment.

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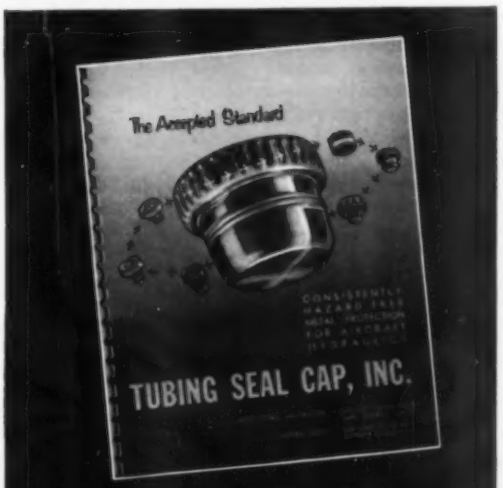

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By Preble Staver

Washington—Commerce Under Secretary for Transportation Louis S. Rothschild vigorously disputed Democratic charges that his department has been hampering civil aviation development and air safety through "ground-minded" economy cuts (AW Jan. 16, p. 28).

Rothschild testified last week before the Senate Commerce Aviation Subcommittee as the first opposition witness to a bill sponsored by Chairman Mike Monroney (D.-Okla.) which would separate the Civil Aeronautics Administration from the Department of Commerce.

Sen. Monroney introduced his measure following the firing of Fred B. Lee as Civil Aeronautics Administrator by the Eisenhower Administration in mid-December. He has used the hearings to inquire into the circumstances surrounding Lee's dismissal.

Rothschild told the Monroney subcommittee that Lee's resignation was accepted "in the best interests of the efficient administration of the CAA." He said any further comment on the matter would be inappropriate since it was a matter resting solely with the executive branch.

Lacked Salesmanship

Under questioning by Monroney, Rothschild indicated that Lee was fired because he had not been a good team man, salesman and planner. The Commerce official said that Lee was not enough of a salesman even to justify the CAA budget request before the House Appropriations Committee. He didn't even get close to it, Rothschild said. Furthermore, he said, Lee had no program to meet future needs of CAA and never developed such a program until required to do so by the congressional Appropriations Committees.

The Commerce Department had grown increasingly disturbed by the lack of action, Rothschild said, and he added, "Quite properly the Congress shared our dissatisfaction with the delay."

Rothschild did, however, express concern at the rapid rate of turnover in the top CAA post. Nevertheless, he said, "it would be a most serious abandonment of our responsibility to the people of this country if we allowed a desire to create a record of longevity to outweigh the requirement that every incumbent of high office must constantly demonstrate the best ability in fulfilling his responsibilities."

Monroney's various attacks recently against the Commerce Department were also taken up by Rothschild. He noted that allegations have been made that the Commerce Department has sought to impede the advancement of aviation by limiting appropriations, interfering with the operation of the CAA, and suppressing reports of vital concern to our aviation interests.

Suppression Denied

"There is no evidence in the record to support any of these charges," Rothschild claimed. He said "there is no truth whatsoever to the charge that we in the Department of Commerce have pinched pennies at the expense of air safety."

Rothschild went to great lengths to refute the claims of suppression. He emphatically denied that the Commerce Department had suppressed a portion of the report of the Presidential Advisory Committee on Transport Policy dealing with aviation matters. He said the report dealt solely with surface transportation matters. A companion report of Civil Air Policy made by the Air Coordinating Committee was released and sent to the Congress, he said.

The subcommittee has been given a copy of the CAA management survey made by Cresap, McCormick and Paget, which is not suppression, Rothschild said. He said it had been left to the subcommittee's direction as to whether or not it should be released.

Monroney's Mistake

Sen. Mike Monroney (D.-Okla.) says it was a mistake, in the light of 15 years' experience, to have put the Civil Aeronautics Administration in the Department of Commerce.

"I see now that I voted wrong," he said. As a freshman representative Monroney had supported congressional approval of President Franklin Roosevelt's reorganization plan transferring CAA to the Department of Commerce.

The Commerce Department is opposed to releasing the report at this time, Rothschild said, because it has not been decided whether the recommendations will be adopted.

Continuous Evaluation

Rothschild also claimed that leaks of the CAA five-year airways plan came from within CAA and that he personally had to order further leaks stopped. The only reason for withholding publication at the time, according to Rothschild, was that the airways plan had not been coordinated with industry or within the Government, nor had it been submitted to the congressional committees which had directed its preparation. He noted that the five-year airways plan has since been delivered to the Appropriations Committees.

Regarding forcing budget limitations on funds for civil aviation, Rothschild said the only policy requirement was to justify fully every request for funds sought from Congress. "There is nothing in the record here or anywhere else to show that air safety has ever been compromised by this policy," the Commerce Undersecretary said.

Rothschild said, "We have continuously evaluated the operations of CAA in the light of best serving the interests of aviation and have taken corrective action whenever the need arose. We have not hesitated to seek adequate funds from Congress when the need for expenditure could be justified—and we have insisted that monies made available by Congress be prudently expended to assure the best possible service to aviation."

It was noted by Rothschild that the CAA budget request for funds to establish air navigation facilities in the current fiscal year was an amount more than three times greater than had been appropriated for the same purpose in Fiscal 1955. He said, "This year the Administration had forwarded a CAA appropriation request for an even greater sum ($40 million) in order to assure prompt initial implementation of the five-year plan.

Opposes Separation

Rothschild was confident that next year's CAA budget increases can be justified. He added: "We are in a better position to obtain more sympathetic consideration from the Congress than has been the case in past years."

Rothschild strongly opposed the Monroney bill to separate CAA from

the Department of Commerce. The bill, he said, would fly in the face of a 15-year bipartisan effort to group Government agencies "in a logical and efficient manner under immediate Cabinet direction."

He told Sen. Monroney that "if your proposal to set up CAA as an independent agency was to be carried to a final conclusion, it would mean no departments at all and all independent agencies in Government."

The Monroney bill, Rothschild said, "Would be a backward step, creating confusion, waste and inefficiency, thereby blocking progress and jeopardizing safety." He said it would have these effects:

- **Spin** the CAA off into governmental space.
- **Reverse** a sound, 15-year trend in Government.
- **Divorce** CAA from its sister transportation agencies now under the Department of Commerce.
- **Contradict** the expressed views of the Eisenhower Administration and the three preceding Presidents.

House Bill

It was stressed by Rothschild that the primary function of CAA is safety. He said to achieve safety goals requires the very best leadership which will produce efficient administration, sound planning and constant evaluation and re-evaluation of all levels of operation. "Deficiencies in meeting this public trust cannot be permitted," he said.

Rothschild concluded that establishment of CAA as an independent agency would be contrary to the best interests of aviation as well as being adverse to good Government management.

Companion Bill

Meanwhile, the House Commerce Committee is preparing to consider a companion bill on CAA separation which was introduced by Chairman Percy Priest (D.-Tenn).

Rep. Priest referred his measure to the Aviation Subcommittee, of which Rep. Oren Harris (D.-Ark.) is chairman, for hearings as soon as time permits.

The House committee chairman claimed "there is ample evidence of unwarranted interference in recent years by the Department of Commerce in aviation matters that have retarded the development of civil aviation."

Consequently, he added, "CAA should be made an independent agency in the interest of both safety and efficiency."

Rep. Harris said that due to the "importance of the subject and the recent unfortunate circumstances," he will schedule subcommittee hearings on the Priest bill "as soon as possible."

Commerce Urges Law to Remove Trunkline Subsidy 'Eligibility'

Washington—The Undersecretary of Commerce for Transportation Louis Rothschild renewed his request for legislation to eliminate domestic trunk airlines for "eligibility" for subsidy in testimony before the House Commerce Subcommittee headed by Rep. Oren Harris (D.-Ark.).

Rothschild recommended:

- **That legislation be enacted** separating airmail payments from subsidy payments. This is now accomplished by executive order.
- **That Civil Aeronautics Board** be given authority to remove airlines that have passed the developmental stage from "even the eligibility for subsidy where this is in the public interest." CAB Chairman Ross Rizley also took this position in a report to the Senate Commerce Committee last year (AW June 6, 1955, p. 123).
- **That subsidies to airlines** in the development phase be paid by "contracts fixing the term of the Government's subsidy obligation and the duration of any such obligation."

Rothschild told the subcommittee:

"We do not believe that subsidy itself is necessarily undesirable. There are times and circumstances which justify Federal financial aid as the only way of assuring the realization of important national objectives. The Federal funds thus far spent for airline support have helped to make possible the industry's spectacular development, with its consequent benefits to our economy and defense. . . . Nevertheless, it must also be recognized that subsidy, in its very nature, represents a governmental intervention into the normal workings of our competitive economy. While such intervention may be necessary under appropriate conditions, it is obviously desirable that the Government minimize its assistance just as promptly as the industry's development will permit."

Declaring that today "there is no more commercial hazard in operating an airline than there is in doing any other thing in the commercial field," Rothschild added:

"I don't know of any other industries that have a timeless call on the Treasury of the U. S. to protect themselves against loss as does the domestic airline industry under present certificates."

He endorsed continued eligibility for subsidy for local service lines and international carriers.

Other witnesses at the hearings were:

- **Crocker Snow**, former president of the National Association of State Aviation Officials, urged that small personal aircraft be exempted from the requirement of airworthiness certificates. He attributed the "retrogression in personal flying" to the fact that it now takes "several years and hundreds of thousands of dollars" to obtain airworthiness clearance from CAB for small aircraft.
- **Two labor representatives** strongly objected to the proposal to withdraw supervisory airline personnel from coverage of the Railway Labor Act. They were James Highsaw of the Railway Labor Executives' Assn. and George Riley of the AFL-CIO.
- **Francis O'Connell** of the Transport Workers Union opposed legislation exempting mechanics of airlines certified by Civil Aeronautics Administration from the requirement for individual CAA airmen certificates.
- **Rowland Quinn**, president of the Airline Stewards and Stewardesses Assn., urged that flight attendants be required to obtain CAA airman certificates.
- **William Kinnard** of the Air Line Dispatchers Assn. urged that coverage of the Railway Labor Act be extended to employes of U. S. airlines overseas.

Delta Enters New York

Delta Air Lines will inaugurate service over one of its newly awarded route segments (AW Nov. 28, p. 12) on Wednesday with flights between New York (Newark) and Washington, Atlanta, New Orleans, Dallas and Fort Worth.

The airline initially will offer three daily flights each way—a DC-7 first class, DC-7 coach and a DC-6 coach—between Newark and Atlanta.

In April, Delta plans to add Charlotte, N. C., Baltimore and Philadelphia to its route pattern; extend DC-7 coach service to Houston, and offer one-stop (Atlanta) DC-7 service between New York and Houston.

Trans-Canada to Purchase Four U. S. Jet Liners

Trans-Canada Air Lines has decided to buy an American turbojet transport instead of the British Comet 4, according to TCA president G. R. McGregor.

McGregor has announced that the Canadian carrier will buy either the Douglas DC-8 or the Boeing 707, but no decision has been made between the two aircraft.

When a decision is reached, Trans-Canada will place an order for four aircraft for delivery in 1961, McGregor said. The order will total $35 million.

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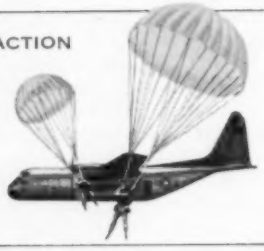

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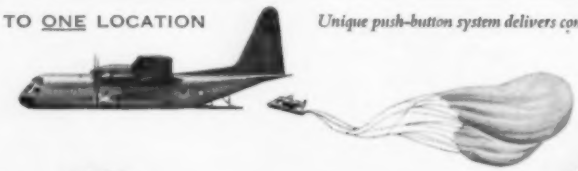

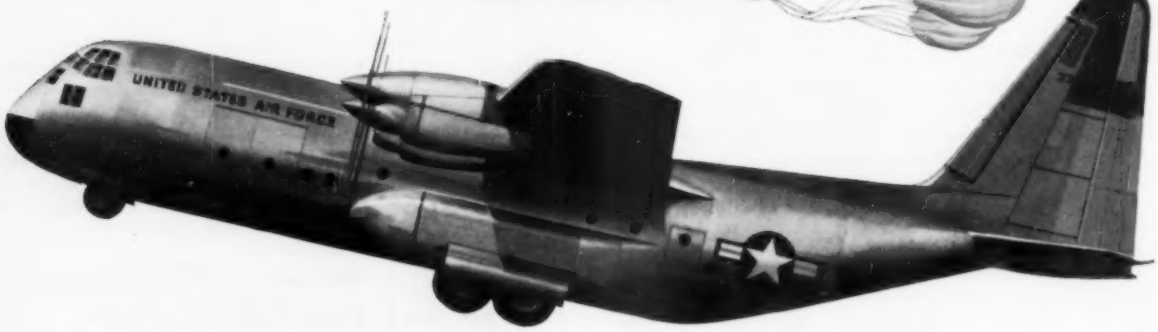

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Boeing Names Two New Divisions To Handle 707, B-52 Production

Boeing Airplane Co. last week announced the creation of a Transport Division and a new Seattle Division to absorb between them the functions of the present aircraft manufacturing operations in Seattle.

The Transport Division will be responsible for the production of Boeing's 707 commercial jet transport and the KC-135 and KC-97 tanker-transports. The Seattle Division will handle the B-52 bomber and "other major developmental projects."

At the same time, President William M. Allen announced the formation of an overall corporate headquarters organization, also to be located in Seattle.

The reorganization was instituted, Boeing said, because of the company's growth and the increased complexity of its products. Allen said it will be accomplished by a "phased transition" and may not be entirely accomplished for a year or more.

Boeing's Wichita Division, Pilotless Aircraft Division and Industrial Products Division will continue their present responsibilities.

Appointment of two vice presidents also was announced by Allen: they are:

• **J. B. Connelly** now director of contract administration, vice president and general manager of the Seattle Division.

• **Lysle Wood**, present director of the Pilotless Aircraft Division, vice president and general manager of that division.

In other reassignments announced by Allen:

Robert Regan, operations manager, Manufacturing Department, Seattle, becomes manufacturing manager of the Transport Division. Maynard Pennell, now chief project engineer-aircraft, becomes chief engineer of the Transport Division.

N. D. Showalter, chief engineer, Wichita Division, becomes assistant general manager of the Wichita Division. Tory Camlem, chief project engineer, Wichita Division, becomes chief engineer of that division. W. W. Rutledge, now operations manager, will become manufacturing manager, Wichita Division.

The newly-created headquarters staff under President Allen includes: W. B. R. Beal, senior vice president, to whom all division managers will report; E. C. Wells, vice president, engineering; F. P. Laudan, vice president, manufacturing; J. C. Yeasting, vice president, finance; Clyde Skeen, controller; Evan Nelsen, treasurer; A. F. Logan, vice president, industrial relations; J. E. Prince, vice president, administration, and secretary, and Harold Mansfield, director of public relations.

In another move, Boeing also announced a regular dividend of 25 cents per share, payable Mar. 9 to stockholders of record as of Feb. 17.

White House Returns Pacific Case to CAB

Washington—The struggle over the great circle route across the Pacific has taken another turn with a White House decision to shift the issue back to the Civil Aeronautics Board for reappraisal.

President Eisenhower has asked CAB to take another look at the question of whether Pan American World Airways should be allowed to fly the great circle route, bring the record up to date and submit a new decision.

The White House action gives Pan American another chance to present its case and temporarily removes the threat of denial, since the CAB originally advised the President to turn down the carrier.

He has been considering his decision since the rest of the Trans-Pacific case was decided last February.

Eisenhower said he is informed that equipment capable of operating nonstop across the Pacific consistently isn't available yet, and in the absence of new considerations, he sees no reason to change his original decision.

But the President also said he has been advised that developments have arisen that may make some of the considerations raised by the CAB no longer applicable. "I, therefore, request the Board to consider the case in the light of any new and relevant circumstances or developments that it finds to exist, and advise me as soon as possible as to its findings and conclusions thereon," he said.

A key factor in new considerations will be the improved subsidy picture in the Pacific. Increases in passenger and military mail traffic have enabled both Pan American and Northwest Airlines to get off subsidy.

A decision on the great circle issue was postponed last year when the President issued his decisions on other issues in the Trans-Pacific renewal case and the West Coast-Hawaii case. The CAB recommended that the PAA application to drop its mid-Pacific stop restriction be denied.

Now the White House has decided to put off a decision again, and CAB will have to reexamine the situation and make a fresh recommendation.

Johnson Elected President Of Air Cargo, Inc.

Emery F. Johnson, 45, was elected president of Air Cargo, Inc., last week at a board of directors meeting in Washington. Johnson first joined ACI, the scheduled airline's aircraft pickup and delivery organization, in 1947 as secretary and tariff agent. He was elected vice president-general manager in 1950. A 25-year veteran of the airline industry, Johnson has worked for Trans World Airlines, United Air Lines and the Air Transport Assn.

LZ-5 Hoists Volkswagon

Doman's recently-certificated LZ-5 helicopter (AW Jan. 9, p. 98) demonstrates its cabin capacity by lifting German Volkswagon. Cabin doors on either side of the 400 hp. LZ-5 open for a distance of seven feet.

FLIGHT DATA IS TELEMETERED from test aircraft, like this modified RF-84F, to receiving equipment in the G-E Flight Test Center. Direct-writing recorders display the test data, allowing immediate engineering evaluation.

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EAL-Colonial Merger Approved By President, Ending Long Battle

Washington—The Eastern-Colonial merger has been approved by President Eisenhower and the Civil Aeronautics Board, ending a three-year struggle by Eastern Air Lines and Colonial Airlines to combine their operations.

The President rejected last minute efforts by National Airlines to block the merger with a direct appeal to the White House after the CAB submitted the case for presidential approval.

Final approval came just three days before the agreement between the two airlines would have expired. Under the agreement, Eastern will take over Colonial's assets with a trade of one share of Eastern stock for two shares of Colonial's. The CAB found that the merger won't result in monopoly or restrain competition.

CAB approval of the agreement contained two conditions. For rate-making purposes, the assets acquired by Eastern must be entered on Eastern's books at their book value on the date of the transfer. And the merger agreement is subject to the labor protective provisions applied by the Board in the Slick-Flying Tiger merger case.

'Arm's Length'

The CAB found that the negotiations between Colonial and Eastern were "carried on at arm's length" and rejected contentions of National Airlines that Eastern retained control of Colonial while negotiations were going on.

The approval of the merger marks the end of a long sequence of negotiations and investigations. The agreement approved last week is the second negotiated between the companies and endorsed by the Board. The first one was rejected by the President because Eastern had gained illegal control of Colonial. Through the whole process, National Airlines has carried on a spirited, vigorous battle to frustrate the merger.

The CAB approved the original agreement in spite of its finding that Eastern had acquired unlawful control of Colonial. The Board felt that public interest factors, including subsidy savings, were more important than the control issue. President Eisenhower didn't agree and turned the proposal down.

National's Views

A control investigation was initiated, and Eastern took steps to terminate its control of Colonial. Last year, the Board found that the control had terminated, and the two carriers submitted a new agreement for approval.

National has fought the merger at the CAB and in the courts. When the Supreme Court finally turned down the carrier, National petitioned the President directly, asking him to send the decision back to the CAB for rehearing. According to the protesting carrier, the President was being asked to approve a merger which violates the law.

National pointed out that in the previous case, the Government found that Eastern illegally controlled Colonial. The carrier said that "nowhere has there ever been a violation so relevant to an instant case and a violation so flagrant and calculated as Eastern's in this case. . . ."

An Eastern-Colonial merger does nothing more than reward the lawbreaker and permit Eastern to keep the fruits of its ill-gotten gains, National told the President.

"Apart from the issue of whether Eastern's illegal activity should be rewarded by presidential approval, there lies the more important question of compliance by the Civil Aeronautics Board with the mandate of Congress for a hearing on statutory issues," National said. The carrier says the CAB denied it a fair hearing on the merger agreement.

National said that a new hearing would reveal a substantial improvement in Colonial's subsidy situation and would show that Eastern's dominance of the East Coast travel market has been extended at a phenomenal rate.

Eastern's board chairman E. V. Rickenbacker called the move "typical of the obstructionist tactics National Airlines has been using for more than three years in their attempt to defeat the EAL-Colonial merger, which every Government agency has found to be in the public interest and which the stockholders of both companies have overwhelmingly approved."

Court Refuses to Grant Stay in Irregular Case

Washington—Nonscheduled carriers became supplemental air carriers this month when the U. S. Court of Appeals decided not to stay the Civil Aeronautics Board decision in the Large Irregular Case.

After delaying effectiveness of the decision from Jan. 1 to Jan. 15 with a temporary stay, the Court of Appeals for the District of Columbia declined to issue a further stay, and the order went into effect. The court still must hear testimony on the merits of the case, since the scheduled airlines have asked for judicial review.

The former irregular and large irregular transport carriers can now operate domestically as supplemental carriers, although the international phases of the decision have been temporarily stayed by the CAB pending a White House opinion.

The two air exchanges authorized for the use of the members of the Air Coach Transport Assn. and the Independent Military Air Transport Assn. also became effective this month.

Supplemental air carrier interim operating authorizations have been issued to 45 former irregular carriers. The CAB listed 49 carriers eligible for the new exemption authority in its original decision, but four carriers have become ineligible. American Air Export and Import Co. received a certificate for scheduled-cargo service, removing it from the list.

Three irregular carriers are ineligible because they have not filed required operating statistics with the CAB. These three—Continental Charters, Caribbean American Lines and Economy Airways—can make themselves eligible for the new authority by filing the delinquent reports.

Harding Report Wins Military Backing

The Harding Aviation Advisory Group's recommendation to the Budget Bureau for a long-range study and planning of aviation facilities under full-time direction (AW Jan. 16, p. 26) has been met with wide acceptance by the Government agencies involved.

The Departments of Defense and Commerce, as well as the Air Force and Navy, all agree with the group's findings.

Reuben B. Robertson, Deputy Defense Secretary, said the report is "excellent and impressive." He said there is no question coordination is needed.

Louis S. Rothschild, Undersecretary of Commerce said "the job at hand could be made a great deal easier if these recommendations are implemented." He pledged his support for continuing coordination with the military.

The Navy will gladly participate in the recommended study, James H. Smith, Assistant Secretary for Air, said. He expressed a hope for an early initiation of the study "under strong technical leadership."

The Air Force re-affirmed its willingness to work with all interested agencies toward achieving a "common system" of air traffic control and "gladly offers to contribute our resources to the recommended study."

Only sour note was struck by Sen. Mike Monroney (D.-Okla.), who took issue with the Harding report.

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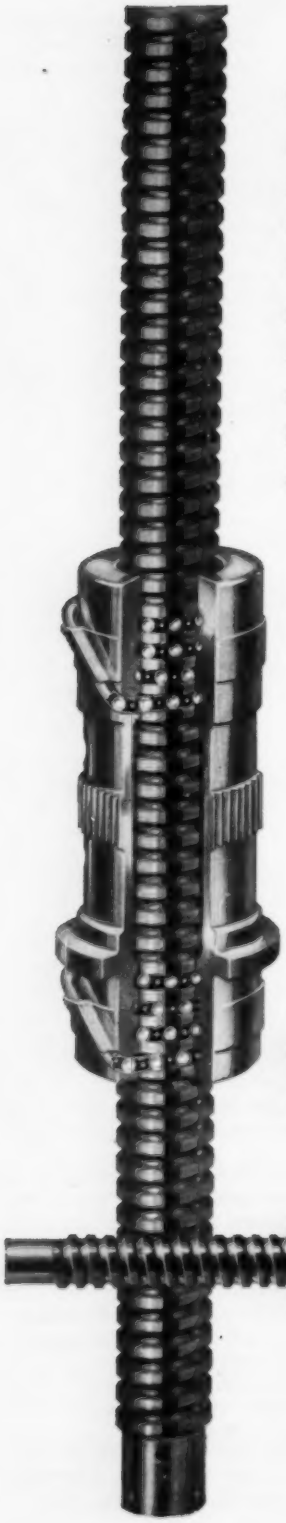

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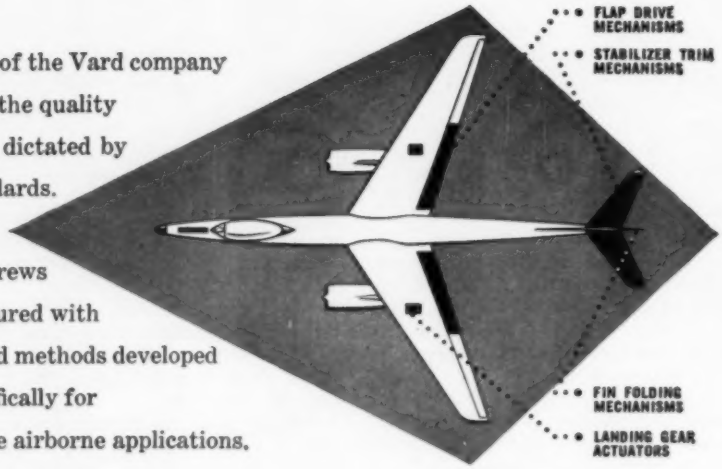

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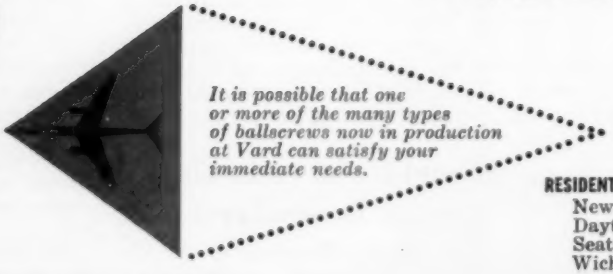

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Convair's 440 Metropolitan

Convair's first production model of its 440 Metropolitan transport is shown above during flight testing. Redesigned engine silencer has a single rectangular opening at the end of each nacelle. At present, Convair has orders for 67 of the transports.

European Lines Plan 20% Summer Increase

Europe's scheduled airlines are increasing passenger capacity 20% to handle anticipated increases in tourist and business travel during the coming summer season.

This summer's increase is substantially more than the 14% increase in capacity made to handle 1955 peak season loads. This year, summer schedules will run generally from Apr. 22 to Oct. 6.

The 20 International Air Transport Assn. airlines which carry most European traffic met in Paris this month to set up schedules for the 1956 peak season. At the meeting, plans were completed to integrate European schedules with intercontinental flights to improve connections for international traffic which will include 70 flights a day to and from North and South America.

The European network will be expanded this summer to include service to Bergen, Bardufoss, Ostend and Venice, and to Ankara where a new airport has just been opened to commercial traffic.

Seasonal services to Biarritz, Berne, Dinard, Deauville, Insbruck, Klangenfurt, Lourdes and Salzburg will be resumed for the summer.

Increased capacity of the European carriers will be provided with delivery of new equipment, including Super-G Constellation, DC-7C, Convair 440 and Britannia transports and S-58 helicopters.

In an effort to simplify the cargo rate structure, the IATA European Commodity Rates Board in Paris has reduced the number of commodity descriptions 52% and cut the number of special rates 40%. This move follows a similar revision of North Atlantic commodity rates made last year.

The Paris group will meet again in June to discuss further simplification and to coordinate the table of descriptions with those of the New York and San Francisco boards. Review meetings every six months are planned for the future.

CAB Orders

(Jan. 12-18)

GRANTED:

General Airways an exemption to perform a charter flight for military personnel on furlough from New York to Paris as the return portion of a U. S. Overseas Airlines charter which Overseas was unable to complete.

Southwest Airways permission to serve Bakersfield, Calif., through Bakersfield-Kern County Airport.

Eastern Air Lines permission to serve Chicago through O'Hare Airport as an alternate to Midway Airport, providing the carrier doesn't serve both airports on the same flight.

Slick Airways an exemption to purchase three DC-6A aircraft from Airwork, Ltd.

Braniff Airways an exemption to provide free transportation to technical employes of Douglas Aircraft Co., Convair Division of General Dynamics Corp., Pratt & Whitney Aircraft Division of United Aircraft Corp., Wright Aeronautical Division of Curtiss-Wright Corp., Collins Radio Co., and Bendix Aviation Corp., until Dec. 31.

Kodiak Airways an exemption to operate between Kodiak, Alaska, and points in an area bound by latitudes 56 degrees north and 59 degrees 30 minutes north, and by longitudes 150 degrees west and 158 degrees 30 minutes west using aircraft having a maximum takeoff weight of not more than 26,000 lb. Kodiak cannot carry local traffic between points in the area certificated to another carrier.

Riddle Airlines an exemption to lease C-46 aircraft from Aircraft Investment Co., Florida Aircraft Leasing Co., and Miami Aircraft and Engine Sales.

Piedmont Airlines an exemption to purchase a DC-3 aircraft from Trans-American Aeronautical Corp.

Riddle Airlines an exemption to purchase a DC-4G aircraft from Trans-American Aeronautical Corp.

APPROVED:

Agreements between various carriers adopted by the International Air Transport Assn. relating to unaccompanied baggage charges.

ORDERED:

Alaska Airlines' final mail rate set at the rate proposed by the Board in its show cause order for the period starting Jan. 1, 1955.

Local airline surface mail rates extended to Jan. 11, 1957, at the rates proposed by the Board in its show cause order.

DISMISSED:

Complaints against Delta Air Lines, Eastern Air Lines, National Airlines, Pan American World Airways and the Dade County Port Authority charging discrimination in fees and charges at Miami International Airport. The Board finds that the charges don't fall within the scope of the Civil Aeronautics Act.

Suspension and investigation of an Airline Transport Carriers fare between San

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Diego and San Francisco, since the fare has been cancelled.

Slick Airways' complaint against a proposal to establish reduced eastbound directional specific commodity rates, since the proposal has been rejected for violation of the economic regulations.

DENIED:

National Airlines' petition for clarification or amendment of the consolidation order in the Florida-Texas service case.

Shortlines

▶ **Central Airlines** has resumed service to Sherman-Dennison, Tex., after a four year lapse with a schedule of four daily flights to points on Central's system. Sherman Airport has recently finished a development program which allows the airline to serve area with DC-3s.

▶ **Denmark's Minister of Traffic** has asked his government for about $347,000 for construction at Copenhagen's airport at Kastrup. Improvements include widening of runways from 49 ft. to 82 ft. and construction of an additional runway. The program will increase airport capacity so that DC-7C aircraft that are scheduled to begin service in 1956 will be able to serve the Danish capital.

▶ **Flying Tiger Line** flew 59,697,650 ton-miles of freight in 1955, a 63% increase over the previous year.

▶ **KLM Royal Dutch Airlines** has opened a service office in Denver . . . KLM has received the first of four Super-G Constellations ordered from Lockheed, and the remaining three aircraft will be delivered this month and in February. KLM will operate the Super-G Constellation in its North Atlantic service.

▶ **Oakland International Airport** handled 164,661 inbound passengers and 174,718 outbound passengers last year, increases of 11,877 and 9,414 respectively over 1954. Landings and takeoffs increased from 181,708 in 1954 to 193,478 in 1955.

▶ **Silver City Air Ferry** carried 57,101 vehicles and 166,219 passengers across the English Channel and the Irish Sea in 1955. Vehicle traffic rose 34% and passenger traffic 48% in the period.

▶ **Southwest Airways** has started service on its new Los Angeles-San Francisco route via Bakersfield with two flights daily.

▶ **United Air Lines** has signed an interline agreement with the Greyhound Bus Line.

BELL Model 47G helicopter lands atop new Statler-Hilton Hotel in midtown Dallas to inaugurate regular air-taxi service to and from Love Field, Carter Field and Fort Worth.

Helicopter Taxi for Dallas

HELICOPTER, operated by Helix Air Transport skims off hotel roof on regular taxi run.

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Communications' Labyrinth

The number of communications required when navigating under instrument flight conditions these days is staggering. It is at its worst near the large metropolitan areas. Describing the incessant chatter on the aeronautical frequencies is a task which is well nigh impossible.

My solution was to keep a log of contacts on a recent flight. And I don't know of any better way to present the picture than to simply list the time of each call (using the 24 hour clock), to whom it went, the reason for the call and the frequency used. This particular flight was a nonstop from Washington to Boston early in December.

Routine Calls

Some of the abbreviations necessarily used in this log are: DCA–Washington; BOS–Boston; ATC–Airways Traffic Control–the "center"; GND CNTL–Ground Control; APP CNTL–Approach Control; TOW– Tower; DEP CNTL–Departure Control.

			mcs.
1123	DCA GND CNTL	for taxi clearance	121.9
1128	DCA TOW	for take-off clearance	119.1
1129	DCA DEP CNTL	for "short range" clearance	120.7
1132	DCA ATC	further clearance	119.7
1134	company	report take-off time	131.4
1140	DCA ATC	report over Baltimore	119.7
1144	company	report Essex & change to NY ATC	131.4
1150	NY ATC	report Port Deposit	125.3
1200	NY ATC	report over Philadelphia	125.3
1201	company	get NY area altimeter setting	131.4
1205	NY ATC	report Mt. Holly	125.3
1212	NY ATC	report Freehold Fan Marker	125.3
1214	NY ATC	report Colts Neck Omni	125.3
1215	NY ATC	report Colts Neck Omni	124.7
1216	NY ATC	report Colts Neck Omni	118.9
1217	NY ATC	receive clearance to 11,000 ft	118.9
1219	NY ATC	report reaching 11,000	118.9
1221	NY ATC	report Woolf Intersection	118.9
1225	company	report Woolf & request weather info	128.1
1236	NY ATC	report Riverhead Omni	125.5
1237	company	report Riverhead & receive weather	128.1
1242	company	report Saybrook intersection	128.1
1246	BOS ATC	report Norwich & receive clearance	120.9
1249	BOS ATC	report Moosup Fan Marker	120.9
1257	company	get BOS altimeter setting	128.1
1258	BOS APP CNTL	report over Franklin marker	118.1
1301	BOS APP CNTL	report leaving 11,000 feet	118.1
1303	BOS APP CNTL	report leaving 9,000	118.1
1305	BOS APP CNTL	report leaving 7,000	118.1
1307	BOS APP CNTL	report leaving 5,000	118.1
1308	BOS TOW	Over outer marker—leaving 3,000	118.3
1311	BOS TOW	leaving outer marker	118.3
1315	BOS GND CNTL	taxi clearance to terminal	121.9

Several points are not self evident from this long list. First, the fact that three calls were made to NY ATC on various frequencies but over the same fix may look silly. This results from a division of the area into numerous sectors each having its own frequency.

Also this log does not take into account the fact that many calls had to be initiated two or three times before being answered. This may have been due to other traffic breaking up the message or the controller being busy with pencil work.

One Every Three Minutes

Some of these calls consumed a bare few seconds; others, because of "repeat backs," etc., took half a minute or more. It also was necessary at times to wait a minute or two for a break in the chatter before starting a call. All this, coupled with the fact that 33 calls (not counting repeats) were made in 112 minutes for an average of three minutes 40 seconds between transmissions points up the "rat race" of present communications.

This flight was not made on a day of particularly bad weather nor abnormally heavy traffic. It was a routine operation.

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Tell them to write to:
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ENGINEERS

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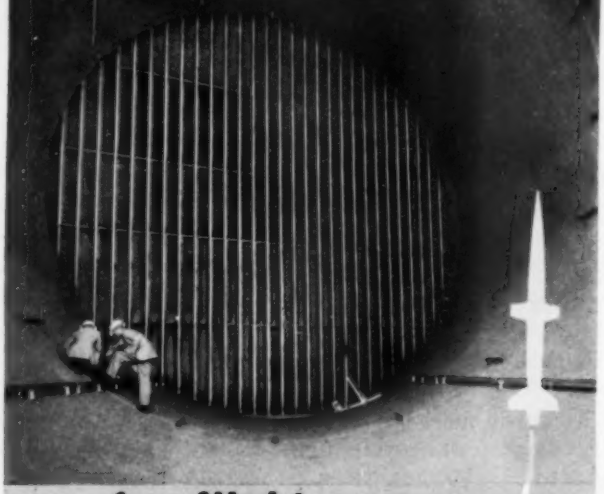

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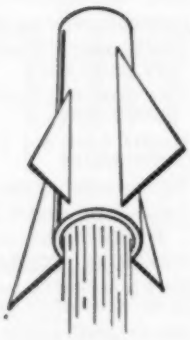

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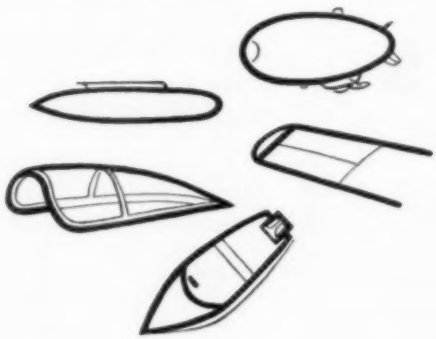

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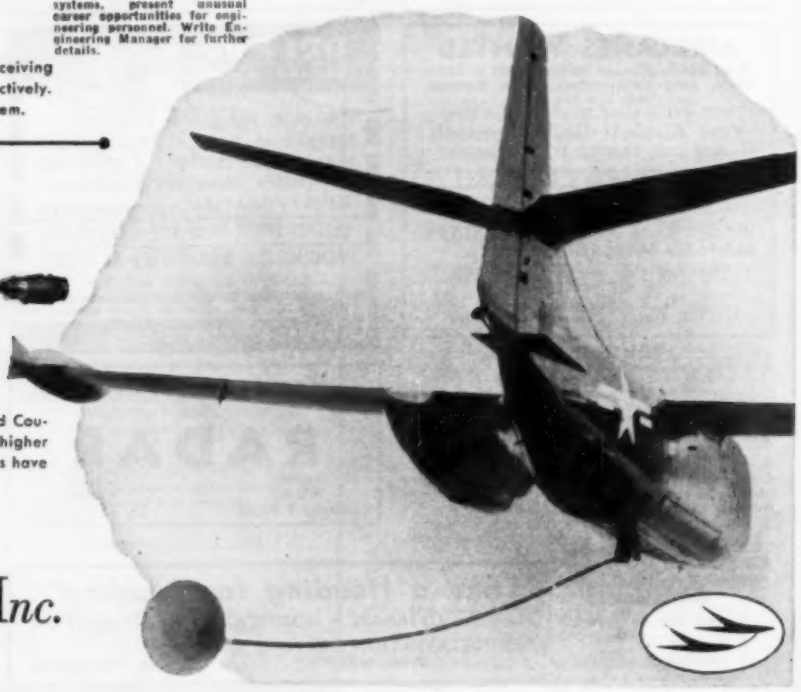

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LETTERS

Underground Industry

AVIATION WEEK remains the best aviation magazine, in my estimation, and thanks to your editorials, you succeeded almost completely in arousing the U. S. to the critical airpower situation. Your May 23, 1955, edition on Russian airpower gains was a huge "boost" to telling the citizens of the U. S. the truth about Russia's latest airpower.

But, in your January 2, 1956 issue, about "dispersing" U. S. factories in the face of new super-bombs, someone has "botched" up the works. In this new policy, the USAF assumes that the assembly plant will remain intact, that there will still be local transportation and also communication facilities will remain.

Just how do they explain that the factory will remain intact? Not after an atomic attack it won't! And, if by some miracle it did remain intact, how about radioactive fallouts? How will workers react to this? And if the workers live, where will they live, eat and sleep?

This idea is okay for "small" wars, but if it comes to nuclear war, there wouldn't be much left. And restoring production would be practically impossible. Everything would be too "hot!"

In my mind, the only way to completely safeguard against all-out attack would be to go underground. Fantastic as this may sound, and costly as it would be, it would pay off in the long run. Germany was able to maintain a monthly production of 2,000 planes *per month*, thanks to these underground factories, which were installed in the last stages of WW II. In this way, the Germans kept the air war going.

Sweden is now doing this very same thing, burying all factories under granite. This makes for an impregnable defense. Places have also been set up for the workers to live in while working, and off the job.

This can be done here. Granted it would take time, money and materials, but it would be as great a safeguard as the deterrent force of the B-36 in early post-war years. At least it is worth thinking about.

L. B. McVICKER
86 Peck Lane
W. Cheshire, Connecticut

Why an F-84 'Anchor'?

I see in your January 2 issue where you have come up with some more braking performance data on the F-84F.

Republic has eased up considerably on their claim about stopping this aircraft from the earlier one published in AVIATION WEEK when the barrier was installed at Farmingdale. I believe they are still a bit unrealistic in their more recent claim. If the aircraft can be stopped in a normal landing in 3,400 feet why bother with an "anchor?" Perhaps the aircraft can be stopped in 3,400 feet, but I don't think it would be termed a normal landing. I believe it would be more accurately described as an absolute maximum braking performance landing.

GRADY L. PATTERSON, JR.
3025 Exmoor Road
Columbia, South Carolina

Aviation Week welcomes the opinion of its readers on the issues raised in the magazine's editorial columns. Address letters to the Editor, Aviation Week, 330 W. 42 St., New York 36, N. Y. Try to keep letters under 500 words and give a genuine identification. We will not print anonymous letters, but names of writers will be withheld on request.

Appeal From Rome

The Rome Air Force Depot, as part of the Air Materiel Command, has worldwide responsibilities for the procurement, supply, installation and maintenance of the ground electronic equipment, facilities and systems of the United States Air Force. At the present time, the Engineering Review and Standards Division of the depot is seriously hampered in accomplishing its mission due to the lack of engineers in the following fields:

Telephone Central Office
Telephone Outside Plant, Ground Radar (search, height, remote traffic control, etc.)
Fixed-Plant Radio (Ground-Air, microwave radio relay, HF point-to-point, etc.)
Computers

The two principle functions of the Engineering Review and Standards Division can be summarized as follows:

a. Establishment of installation criteria (similar in purpose to Bell Practices) for ground radio, radar, telephone and meteorological facilities and systems. These practices are utilized by Air Force field operating and engineering personnel in the programming, budgeting, siting, planning, preparation of installation plans and the construction of facilities and systems.

b. Review of installation plans submitted by field engineers for technical adequacy and capability of furnishing the service required for the operational mission and as stated in the Operational Plan prepared by the customer.

The majority of the work is accomplished at Griffiss AFB, Rome, N. Y., but with ample opportunity for the project engineers to visit the operational commands, laboratories of other services, industry, construction sites and field engineering agencies.

The close collaboration with the Rome Air Development Center, other service laboratories and industry permits our engineers to increase their professional qualifications and keep abreast of the latest techniques and developments in the electronic field.

In addition, an educational program in conjunction with Syracuse University is available for those interested in advanced degrees.

The annual salaries for present vacancies range from $5,440 to $7,570. Position descriptions have been approved for the vacancies.

Engineers interested in the above positions should submit a Standard Form 57, "Application for Federal Employment," to:

Commander
ROME AIR FORCE DEPOT
ATTN: MRMN—Engineering Review & Standards Division
Griffiss Air Force Base
Rome, New York

Additional information can be obtained from the above address.

P. G. CARNEY
Box 1102
Griffiss Air Force Base
Rome, New York

The Missing Picture

In the January 2, 1956, issue of AVIATION WEEK there appears an article on page 55 entitled "Home-Built Roadable Plane Costs $250." The two upper cuts show the plane with pusher type engine. The lower cut shows plane with conventional configuration. I'm confused!

WILLIAM ARSICS
Metal Textile Corporation
Roselle, New Jersey

(Arsics and other readers have every right to be confused. The third picture, inserted through a printer's error, shows a German light plane designed by Heini Dittmar. The picture that should have run is shown below—Ed.)

Bendix Products Division

A DEPENDABLE SOURCE

FOR CREATIVE ENGINEERING AND QUALITY MANUFACTURING

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FOR EXAMPLE . . .

Bendix* Torque Link Steering represents a notable advancement in easier and more efficient steering action and at the same time effects important savings in weight, space and maintenance.

This new and better nose strut is a rugged self-contained unit that can be built in as an integral part of any nose strut. It actually does the work of two conventional mechanisms with the hydraulic power cylinders taking the place of the upper scissors member of the usual torque link.

Thus, with one unit performing dual functions, Bendix Torque Link Steering gives important savings in weight, space and maintenance.

In addition, shimmy dampening is more effective because dampening forces are applied at a point where there is the least amount of spring action in the system.

Torque Link Steering is another striking example of Bendix creative engineering and quality manufacturing furnishing solid evidence that the aircraft industry can continue, as in the past, to look to Bendix for the best solution to their problems.

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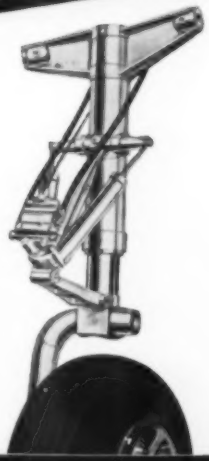

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Test-Flies on One Engine with 13,000 lbs. Overload — that's the Fairchild C-123

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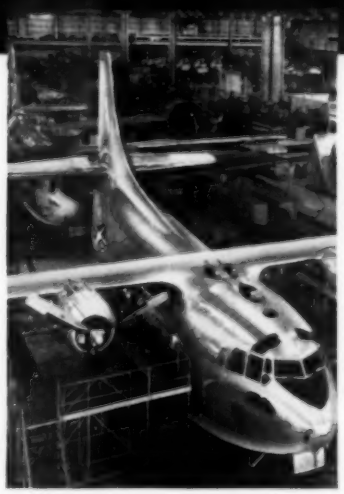

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